SCIENTIFIC AMERICAN

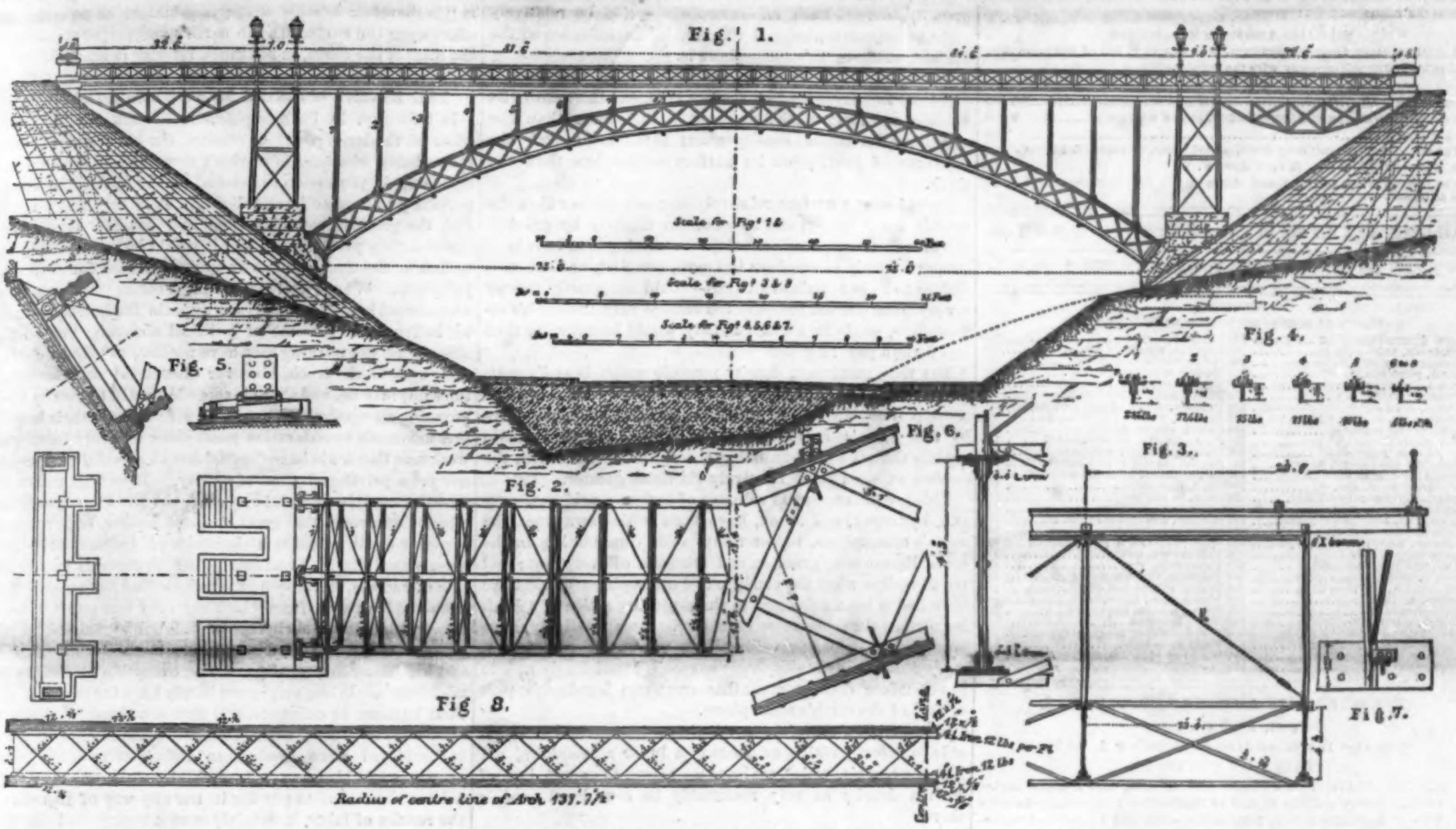
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

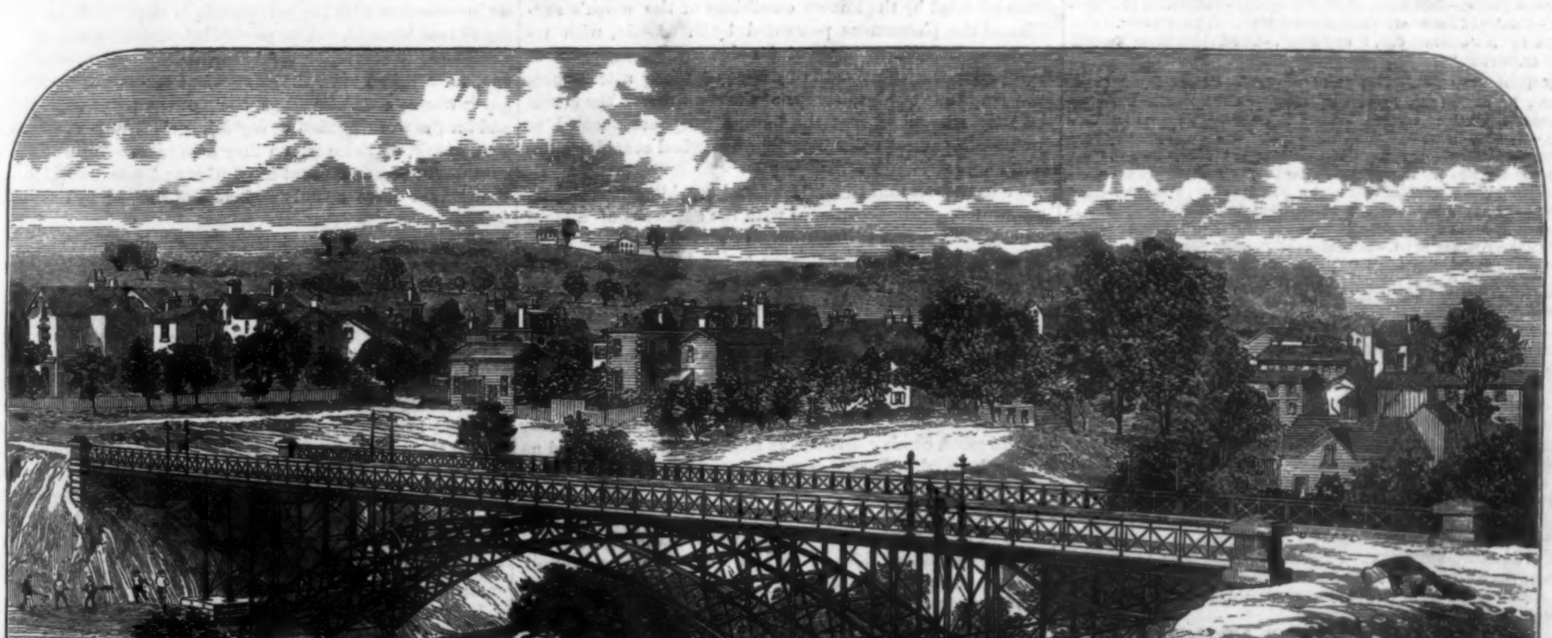
Vol. XXXV.—No. 10. [NEW SERIES.] NEW YORK, SEPTEMBER 2, 1876. [$3.20 per Annum [POSTAGE PREPAID.

NEW BRIDGE AT PITTSBURGH, PA.

The engraving published herewith represents a bridge erected two years ago at Pittsburgh. The length of the bridge is 250 feet, the clear span 150 feet, and there are side openings of 40 feet each, with roadways and sidewalks along the river's banks passing through them. It was decided by the commissioners who had charge of the work that the bridge should be calculated for a movable load of 100 lbs. per square foot, or 4,000 lbs., per lineal foot, with a factor of safety of 5. The bridge was designed by Mr. Pfeifer, and constructed by the Iron City Bridge Works, of Pittsburgh. The contract price was about $36,000, whereof $12,000 were for the excavation and stone work.

The main arches of the bridge were fitted together in the shop, but taken apart again and put together in place on scaffolding. The ravine crossed by the bridge is for the greater part of the year dry, and will in course of time be occupied by Boundary Avenue, a street of 80 feet in width, making with Forbes street, on the center line of the bridge, an angle of about 60°. In the elevation, Fig. 1, a section through this intended street is shown. The general construction of the bridge, says *Engineering*, to which we are indebted for the illustration, is so clearly shown by the views we give that no detailed description of it will be necessary. We may mention, however, that Fig. 8 is a diagram showing a development of half of one of the arched ribs, the rib being drawn straight instead of curved to its proper radius. The mode of adjusting the bearing of the ribs on the abutments is shown by Fig. 5. The other detail figures will explain themselves





WROUGHT IRON BRIDGE AT PITTSBURGH PA.

Scientific American.

ESTABLISHED 1846.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 87 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included....................$3 20
One copy, six months, postage included.................... 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included....................$27 00
Over ten copies, same rate each, postage included.................... 2 70

☞ The postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

Scientific American Supplement.

A distinct paper from the SCIENTIFIC AMERICAN, but of the same size, and published simultaneously with the regular edition.

TERMS.

One year by mail....................$5 00
SCIENTIFIC AMERICAN and SUPPLEMENT, to one address.................... 7 00
Single Copies.................... 10

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & Co., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

VOLUME XXXV., No. 10. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, SEPTEMBER 2, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 36.

For the Week ending September 2, 1876.

TABLE OF CONTENTS.

THE MOON'S ATMOSPHERE.

The moon has no atmosphere, the text books tell us: or if any, it is comparable in density only to the best vacuum to be obtained in the receiver of an air pump. Bessel estimated the greatest surface density possible in a lunar atmosphere, consistent with lunar phenomena, to be the thousandth part of that of the earth's atmosphere; and most writers on astronomy have accepted his conclusion as final.

But it has been found that the calculations which led Bessel to this result were vitiated by serious errors and omissions. He failed in the first instance to take account of the difference in the force of gravity on the moon and on the earth. Allowance being made for that, it appears that the surface density of the moon's atmosphere may be three times what Bessel made it. He also overlooked the influence of temperature. Making the necessary correction for this element, his equation shows that, so far from being limited to a density a thousand times less than that of the earth's atmosphere, the moon's atmosphere may be five times as dense, or one two-hundredth that of our air. In view of the diminutive mass of the moon and the feeble action of gravity upon its surface, such an atmosphere would be relatively quite as important, quite as effective in its influence on the surface, as the earth's atmosphere is.

Taking the earth as unity, the diameter of the moon is less than two sevenths; its surface area, one thirteenth; its volume, one forty-ninth; its mass, a little more than one eightieth; its mean density about three fifths; and the force of gravity on its surface rather less than one sixth.

Spread over a surface relatively so much greater than the earth's (as $\frac{1}{13}$ to $\frac{1}{81}$) and acted on so slightly by gravity, the moon's atmosphereic envelope—assuming it to have been proportionately as ample as the earth's at first, and the conditions to have remained similar—would necessarily occupy a very much greater comparative volume than the earth's atmosphere, while its surface density would be not more than one fiftieth part as great.

But this maximum density possible under Bessel's estimates must greatly exceed the density actually possible at the present time, since the absorption of the moon's atmosphere by the moon's surface must have gone on much more rapidly than the corresponding absorption by the earth, the surface exposed being relatively six times greater.

Think what enormous volumes of carbonic acid gas, oxygen, hydrogen, and so on, have been withdrawn from the earth's atmosphere, to enter into solid combination in the coals, limestones, granites, and minerals of every sort; and try to realize what the condition of atmosphere would have been had it been subjected to the absorbing action of a similar surface six times more extensive. Such, relatively, have been the conditions prevailing in the moon. If correspondingly reduced, its atmospheric envelope is not likely now to have surface density more than one three hundredth part of that of the earth's atmosphere.

The question therefore is whether astronomers have been able to detect positive evidence of a lunar atmosphere, not like the earth's, which we have no reason to expect, but of such a density as may reasonably be considered possible there.

In his recent able and authoritative treatise on the moon, Neison remarks that all astronomers who have devoted much time and attention to the detailed examination of the lunar surface have recognized more or less direct indications of a rare lunar atmosphere, besides the more indirect evidence afforded by the known conditions of the moon's surface and the phenomena presented by it. Again, with reference to Bessel's estimate of its density, he says: "But this opinion was coincided in by none of those astronomers to whom is due our knowledge of the condition of the moon, and they recognized that the lunar atmosphere seemed to possess a greater density than the theoretical considerations would appear to permit."

We have seen that those theoretical considerations rightly interpreted, are in accordance with the existence of a lunar atmosphere, very far from being insignificant; and it remains simply to examine the evidence borne by observable phenomena.

The only methods sufficiently delicate to detect unmistakably a lunar atmosphere, having a surface density less than one hundredth that of the earth's, are those based on the refraction of a ray of light traversing it; and of these the most trustworthy is that based on the observed times of lunar occultations, that is, the cutting off the light of a star by the moon coming between us and it. If the moon had no atmosphere, the disappearance of the star should coincide exactly with the calculated time. With an atmosphere of appreciable density, the disappearance of the star must be delayed by refraction. The difference between the observed and the calculated time of an occultation would, therefore, furnish a measure of the density of the lunar atmosphere, provided the calculated time were minutely exact.

Unfortunately this requires the moon's diameter to be exactly known, but that is still doubtful within very small limits, owing to the disturbing effect of irradiation. As the result of some hundreds of recent observations with powerful instruments, however, occultations appear to be retarded from five to ten seconds more than can be accounted for by the effects of irradiation. Consequently the existence of a lunar atmosphere sufficiently dense to produce the difference found is not only possible, but very probable, considering the consistent nature of the results obtained by observations and the apparent inadequacy of other causes to explain them. The maximum surface density of the moon's atmosphere, according to these conditions, is about one two-hundredth of that of the earth; but this result must be considered as merely probable, the exact density being unobtainable with the observations at present existing, owing, as already noticed, to the uncertainty as to the moon's exact diameter.

Among the appearances which are regarded by students of the moon's phenomena as proofs positive of a lunar atmosphere of considerable density, we may mention the twilight at the cusps of the moon, the dimness and obscurity observed at times in certain localities while surrounding objects stand out sharp and clear, the blue, transient fringe to crater walls at sunrise, the local and quickly disappearing gray border to the black shadow of some of the deep crater formations, the misty appearances within deep craters at sunrise, and the blotting-out of surface details by mists which vanish as the sun rises.

After reviewing at length the evidence of these and other lunar phenomena, Neison decides that the existence of an atmosphere to the moon must be regarded as certain; the only uncertainty that remains is with respect to its density, which he is persuaded must in all probability lie between three and four hundredths of that of the earth's atmosphere. It "is therefore capable of exerting almost as powerful an effect upon the surface as the earth's, and, proportionately to the mass of the moon, is not much inferior in amount."

THE RECENT WORKING MEN'S DEMONSTRATIONS.

In this city, in Philadelphia, in Newark, and in many other of the large populous centers, the abnormal spectacle is now being witnessed of working men banding together and marching in procession to demand of the authorities an opportunity to earn an honest living. It is impossible not to feel the greatest commiseration and concern for men reduced to this predicament, and it would be uncharitable not to find in the circumstance every condonation for errors of judgment. We are well aware that it is like offering stones, when bread is asked, to answer appeals for immediate help by indisputable maxims of political economy; but on the other hand, the working men have nothing to gain by closing their eyes to the truth, however distasteful or unfortunate the same may be, and there is something still to lose by their pursuing a course which can in no wise enure to their benefit

A moment's consideration must show to every intelligent workman that his is in reality neither an especially oppressed nor yet a privileged class of society. If he will remember that the terrible financial stress of the last three years has affected everyone, that great business houses, believed to be superior to all possible vicissitudes of fortune, have been utterly annihilated, great enterprises, apparently in the full tide of success, have been arrested, that we have experienced not a sudden panic, from which recovery was possible, but a slow yet inevitable shrinkage of value in all things, he will perceive that by no combination of circumstances could he and his fellow laborers be made an exception to the general misfortune. When employers barely have the means to keep their business in existence, and then are thankful that their affairs are no worse, when, as must be the case, every penny is considered more closely than dollars were before, when people cannot hire men to do work, simply because they have neither the money to pay for it nor any way of disposing of the results of labor, it certainly cannot be expected that work can go on. Nor is there any sudden and rapid method of forcing the same into existence.

There is no greater mistake than to suppose that government can do this. The governing power is not paternal here, as in France or Russia. No one would more quickly resent its interference with his private affairs than would the working citizen himself. The particular persons whom we call President, or Mayor, or Governor, or Aldermen, who manage, for brief periods, the mechanical proceeding incident to government, are but paid servants of the public, not rulers and for the working men or any other class of sovereign citizens to ask, of those whom they hire to do certain work, an exercise of power without the duties and powers which they themselves have strictly defined and limited by law is not sensible.

Again, it would not be just that one part of the population, because it earns a living by daily physical labor, should be provided for to the exclusion of every other class. The employer who may be laboring at his desk until his bodily powers threaten to succumb, in order to avert impending ruin, has an equal right to assistance. The butcher, the grocer, all the retail trades' people, who are dependent on the working man's custom for their living, would be equally justified in asking help because the working men now buy less of their commodities. It is clear that, if the State had power to make work, that work would have to be paid for by the people, through taxation; and when the working man came to spend his earnings, he would find that they would buy just so much less meat and coal in proportion as the dealers, through their increased taxation, have been compelled to raise the prices.

It seems to us that the only sensible course at hand is for the men to bear their misfortunes patiently, to be vigilant; and when any honest labor, no matter what, does appear, to take it and be content with any wages that will afford support. We say plainly that the present is no time for strikes such as the longshoremen and stone cutters have been making, no matter what the pretext, and that the period is still less propitious for enforcing dicta of trade societies or the unwritten laws of trade etiquette. We believe there is a deep-felt sympathy for the working men pervading the community, and that there is a growing tendency to afford employment whenever it can possibly be done. It remains for the men who join in processions and other demonstrations to see to it that no hasty or ill advised action, on their part, impairs this favourable public sentiment.

IS ANYBODY SANE?

That is to say: Is anybody so happily constituted that there is no corner of his mental organization in which he is prepared to admit, consciously or unconsciously, that somehow or somewhere the impossible may happen?

For our part we are inclined to think that perfect sanity, like perfect health, is a condition impossible in the present stage of human development. It is our misfortune as well as our advantage that we are heirs of all the ages. The past remains with us; so that every man carries more or less of the imperfection, the lower life, of all the long series of life forms, reaching back to the beginning.

Without going the length of the litanies and saying there is no health in us, we are nevertheless compelled by every day experience to admit that the best of men fall far short of that state of perfect healthfulness in mind and body which we can readily conceive to be possible, and to which the human race may sometime attain. The best of men inherit physical and mental weaknesses—more correctly, organic imperfections—from ancestors near and remote, which show themselves not only in the outer form but also in the inner constitution, in mental and moral traits as well as in bodily habits and diseases. In like manner man in the aggregate, that is, society, inherits creeds, customs, conditions, and surroundings, which tend powerfully to thwart the normal development of the individual.

For this reason, in the progress of nations, insanities in thought and action have not merely to be overthrown by what is right and true, but slowly outlived and eliminated from the constitution of the race by a long process of natural or artificial suppression. And often the foremost men of a nation have quite forgotten an outgrown error, a once prevalent vicious habit of thought or phase of epidemic insanity, long before it has entirely vanished—literally died out—among the masses. Not unfrequently, too, some seemingly trivial occurrence will start an astounding revival of the long quiescent evil, causing it to burst forth like a mental plague to ravage nations supposed to be beyond its contagion.

The recent wide-spread development of the delusions covered by the general term spiritualism is an instance in point. It is a revival of witchcraft and devilmongering, characterized by many of the obliquities and intellectual vagaries of rampant insanity. Men smitten with the disease cease to be amenable to reason in all matters connected with spiritualistic delusions. The most patent and ridiculous of frauds and follies, reputedly involving spirits and their mediums, are accepted by them with religious enthusiasm. They glory in their shame, proud to be fools in so sublime a cause. In all other fields of thought they may be shrewd, sensible, and logical to a degree; in this, the plainest demonstrations of the unreasonableness of their views, the most palpable proof of the dishonesty of their trusted "mediums," glance off from their minds like raindrops from a duck's back, making absolutely no impression.

The most amazing feature of the case, regarded otherwise than as a phase of insanity, is the prevalence of the delusion among the intelligent and well-to-do. No grade of society is exempt, though it runs more or less in streaks; and no amount of rebuff or exposure seems to lessen the victim's confidence in the absolute wisdom of his foolishness

The numerous and curiously varied clientage of Flint, the swindling tea kettle medium, affords abundant illustration. A clumsy and illiterate humbug pretends to answer, under spirit guidance, sealed letters (unaddressed, though directed within to the spirits of the dead), returning in each case the desired reply properly signed, with the letter of inquiry unopened, all for two dollars: and straightway men and women, of every rank in life, flood his office with banknotes and queries, in confident expectation that their departed friends and relatives will make them wise before their time.

From the newly appointed minister to England, who wants an improved family tree to give him something more than official rank at the Court of St. James, down to the gushing miss of doubtful virtue, who expects to be a medium and wants to know whether she will "wright impressnoley or makonakley," the whole lot of them seem to be on the same level of intellectual imbecility the moment they enter the spiritualistic sphere: a level so low that the medium's silly rant and senseless doggerel seem to each and all to be the natural talk of dead statesmen and dead fools alike.

No doubt some of them, now that their silliness has been been exposed by the medium's letter book, feel somewhat as the swindler did when he said to the reporter in jail: "I feel as if I should love to get out of here and fly!" Even the Honorable Mr. Pierrepont must feel a little like flying when he sees his correspondence with "My dear Lady Mary" in print, and has to face the chaffing he so richly deserves. But will his faith in spirit communications, or the faith of any of them, be shaken in the least? We very much doubt it. To sane people the conviction of ninety-nine people out of every hundred mediums as pitiful tricksters and knaves is presumptive evidence that the unexposed hundredth is no better, but not so with the faithful. With them it is not a matter of experience or judgment, but a pure delusion, which no dishonesty on the part of mediums can stagger. The venerable and credulous seeker for aristocratic connections did not slacken his pursuit in the least when the disgusted female Flint told him the secret of the tea kettle. What if the letters were opened and copied? What if the medium were a beggarly fraud? Could not the spirit of "My dear Lady Mary" make use of him all the same?

A few days ago a poor lunatic, in great agony of spirit, poured into our ear a pitiful tale of impossible ancestry: his great-grandmother was—say a kangaroo.

"But," we objected, "all this seems to hinge on the conjecture that your grandfather was a camel."

"To be sure!" he replied, with insane vehemence, "to be sure; but, you know, in my clairvoyant state conjecture *to me* has all the force of demonstration!"

That is precisely the mental condition of most spiritualists touching matters spiritualistic. Their conjectures about spirit life and spirit action have to them all the force of demonstration. In other fields of thought and action, they may be as sane as our unhappy friend was except where his paternity was involved; but in this field they are blindly irrational, incompetent alike of reasoning or of feeling the force of the reasoning of others

But—more's the pity!—spiritualists are not the only people who lead a double life, sane on one side, insane on the other, taking conjectures for what they are worth in most fields of thought, but exalting conjecture above all things else in some special field. The world is full of people who, with more or less enthusiasm, expect the impossible to happen somewhere. A fraudulent motor violates the plainest principles of science: therefore they believe in it. A dogma runs counter to all experience: therefore it must be divinely true. "I cannot comprehend: therefore I believe," is their ideal of spiritual exaltation; and too often they are ready to assign to a protracted and disagreeable future all such as cannot share their particular insanity.

The disease, more or less virulent, is indeed all but universal. When it involves matters of every-day real importance, we seclude the victims and subject them to medical treatment; when it deals wholly with the unreal, we—well, sometimes we call them philosophers and sometimes we canonize them; but it is the same disease, with varying intensity, throughout. The man who sees snakes in the air is sick; he who beholds angels is supremely blest!

Is there any cure? We are happy to believe there is: in time, and the slow development of the race toward perfect sanity. For untold millenniums the human race has been stumbling upward through intellectual infancy, acquiring much and forgetting much. By degrees men are learning to distinguish the real from the imaginary, to abide more and more by reason and sound experience, putting less and less faith in conjectures. Ultimately men may develope into a race purely rational, capable not only of habitually drawing right conclusions from correct premises, but of always refraining from positive judgment until the premises have been fully established and properly verified: a race constitutionally sane.

But progress in that direction cannot be very rapid until men have ceased, in each and every department of thought, to make a virtue of insanity: in other words, have ceased to set faith in the unverified and inconceivable above every other faculty, studiously training the young to be irrational. Not until the current methods in education are exchanged for more wholesome and rational methods, not until men have learnt at all times and in all connections to treat conjectures as conjectures—pleasant to think about sometimes, and sometimes very useful as aids and inspirations in the pursuit of knowledge and the development of character, but never to be mistaken for truth or rated as a superior kind of truth—then, and not till then, will the race cease to be liable at all times to outbreaks of epidemic insanity. Then, and not till then, will it be impossible for swindles of the Flint and Mummler and Katie King and Keely motor order to flourish outside of insane asylums.

HOW TALL ARE WE?

In discussing the results of the tables of measurement of drafted and enlisted men, prepared from the records of the Provost Marshal General's Bureau, made during the late war, Dr. Baxter remarks that probably no question of anthropology has been more debated and none left in a more unsatisfactory condition than that of the mean stature of the full grown man. The reason for this he finds principally in the confused manner in which measurements have been prepared for the purpose. "Hights of young and old, of men of widely differing nativities, of picked men, such as soldiers and militia, of men and women, of students under the age of full growth; of convicts, a class generally below the mean hight of their countrymen; of men measured in shoes and men measured without shoes, have been compared together in tables pretending to exhibit scientific conclusions!"

The half million sets of measurements, from which the conclusions to be summed up in this article were derived, are open to none of these objections. They were actual measurements, not guesses. They were measurements taken with a reasonable exercise of care by surgeons sworn to do their duty, furnished with needful aids and appliances, and without object or interest in evading or slighting their official instructions. And the records include the measurements of rejected as well as of accepted men, so that they fairly represent, not a picked portion of the men of the country, but the whole.

It is proper to observe here that the measurements made use of in this report were chiefly those of men examined towards the latter part of the war, after the finest fighting material of the country had been enlisted; consequently they under rather than over state the average development of the American people. It was a time, too, when large bounties invited many of the better class of foreigners to enter our service: a partial explanation, perhaps, of the fact that in every instance the mean hight of our foreign-born soldiers was above that of the nation represented. Under such circumstances, it is gratifying to see that the first rank in stature is won by our native Americans, a somewhat discouraging circumstance to those who assert that our country and climate are destructive to the white race. Curiously, the list is headed by a small number of aboriginal Indians. Dr. Baxter is of opinion that this is not due to their being picked men, but to the fact that the Indians are really a tall race. In Mr. Gould's tables of statistics, gathered by the Sanitary Commission, 517 Indians show a mean hight considerably above that of the following table. If compared with the natives of the United States only, the Indians (enlisted Indians, that is) would rank as ninth in the list of States.

Here follows the table showing the superiority in stature of 501,068 men, of different nativities:

Order of Superiority.	Nativity.	Number of Men Examined.	Mean Hight in Inches.
1	United States, Indians, ...	121	67·934
2	United States, whites, ...	315,620	67 672
3	Norway..................	2,290	67·467
4	Scotland..................	3,476	67·066
5	British America	21,645	67·014
6	Sweden..................	1,190	66·896
7	Ireland	50,537	66·741
8	Denmark	383	66·648
9	Holland	989	66·637
10	Hungary..................	89	66·584
11	England..................	16,196	66·577
12	Germany..................	54,944	66·536
13	United States, colored, ...	25,828	66·531
14	Wales..................	1,104	66·418
15	Russia	122	66·393
16	Switzerland..................	1,802	66·381
17	West Indies..................	580	66·307
18	France	3,243	66·277
19	Poland	171	66·211
20	Mexico	91	66·110
21	Italy..................	339	66·000
22	South America...........	79	65·899
23	Spain..................	148	65·635
24	Portugal	81	65·432
	Total and mean of total	501,068	67·300

Two thirds of the native-born white Americans were fair-complexioned, but their mean stature was one tenth of an inch below the dark-complexioned. Among the natives of British America, England, Ireland, and Germany, the fair exceeded the dark in about the same proportion, while the dark show a slight superiority in stature, except in the case of Ireland, the light and dark complexioned natives of which had precisely the same hight.

Graded according to the mean stature of the inhabitants (American born whites), the different Northern States stand as follows:

Order of Superiority.	State.	Number of Men Examined.	Mean Hight in Inches.
1	Kentucky............	4,252	68·677
2	Kansas..................	729	68·551
3	Minnesota..................	3,682	68·371
4	Missouri..................	6,031	68·337
5	California..................	1,308	68·306
6	Nevada..................	21	68·286
7	Indiana..................	38,354	68·080
8	West Virginia............	5,187	68·005
9	Wisconsin	10,922	67·911
10	Maine	12,363	67·895
11	Iowa	7,823	67·895
12	Illinois	36,465	67·835
13	Michigan	12,583	67·826
14	Maryland...	6,918	67·814
15	Ohio..................	39,311	67·782
16	Vermont..................	3,374	67·583
17	Delaware	1,215	67·490
18	Pennsylvania..............	47,124	67·470
19	District of Columbia	2,883	67·353
20	Rhode Island............	3,013	67·290
21	New York............	43,798	67·274
22	New Jersey..............	17,084	67·023
23	New Hampshire.........	2,801	66·929
24	Massachusetts	6,280	66·891
25	Connecticut..............	2,099	66·587
	Total and mean of total	315,620	67·672

According to Dr. Coolidge's examination of United States Army statistics, from 1839 to 1855, the mean stature of recruits from Georgia, Tennessee, North Carolina, South Carolina, Alabama, and Virginia ranged between 68·272 inches for the first and 67·488 for the last named. The average for the whole country, obtained from Dr. Coolidge's tables, was 67·357 inches, about one third of an inch below that derived from the records of the Provost Marshal General's Bureau (67·672 inches) for the Northern States; while that obtained by Mr. Gould, from the statistics of the United States Sanitary Commission—on the whole less accurately taken—was smaller yet, by about one hundredth of an inch. The close correspondence of the three sets of observations is an indication of the accuracy of the whole. Altogether they are the results of measurements of nearly a million and a half of American born white men, and the resulting mean stature of the whole is 67·646 inches. Even the lowest mean obtained would entitle the American people to the first rank among the nations in point of stature.

REMARKABLE ARTESIAN WELL.—At Prairie du Chien, Wis., an artesian well daily discharges 869,616 gallons of water. The well is only 960 feet deep, but has head enough to raise the water 900 feet above the ground.

SHOCKS of earthquake were felt, on July 5, at Corinth, Greece. The direction was east to west. On July 17 three violent shocks occurred in Vienna.

IMPROVED DREDGING MACHINERY.

The apparatus shown in our engraving is designed for cutting canals, deepening lakes, etc., and can be largely used in the work of reclaiming land. The barge, which carries the machinery, and the frame for carrying the mast or jib, are made of wood. A boiler, on deck or below, supplies steam to a small pair of engines on deck, which work two drums, two chains being necessary, which run over a double block or pulley, A. One chain, P, which may be a lighter one than the other, acts on the frame of the bucket, B B, and lowers it open. As soon as it is required to drag, the second or heavy chain, R, acts on the frames and side chains at D D, and causes the shaft, E, to unwind, which causes the bucket to close, as at C, and the sharp edges enter the ground. Though the edges jam, the chain goes on all the time, and the action becomes one of lifting, and the charge of earth or mud, often weighing two tuns, or measuring one cubic yard, is lifted through the water; and the man at the winch or or engine, knowing where he is going to dump it, puts in motion the wheels, H, acting on the chains, G, which guide the head of the crane, F, over the spot. As soon as the loaded bucket is over the barge, or the land where the charge is to be dropped, the man holds on to the first chain and lets the second chain slack, and the bucket opens, and so rapid is the motion that a single engine driver can excavate and dump four tuns per minute.

The barge is very often moored, says the *Engineer*, from which journal we select the engraving, by two poles or stilts at the sides, which are raised by a winch. This saves the time of pulling up an anchor, and keeps the barge steadier, and the advantage is that a mark can be tied on the chain; and whenever this comes to the same spot, the engine driver knows he is deep enough, and a level can be secured under water. When it is necessary to lift rock and stones, then the bucket is unhooked at O, and a pair of claws hooked on to the two chains, which claws act in a similar manner to the bucket. The tool is used for wrecking, and will work to the greatest nicety in a depth of water far below that at which any diver could descend. It has also the advantage that two men can work it with ease.

The Philadelphia Exhibition.

As time progresses, the Centennial Exhibition at Philadelphia arrives at a condition of more perfect completeness, and with the bright summer weather the surrounding grounds attain even more beauty than they possessed upon the opening day. The crowds, which are almost lost within the great enclosure, save at the special points of popular attraction, increase in number every week; and though probably some slight falling off in the attendance is to be expected in the burning months of July and August, there is little reason to doubt that this decrease will be far more than made up by the mass of visitors during September and October, always the two most crowded months at any exhibition.

The Exhibition is but, as it were, a handbook only to the great industrial developments of the United States, developments which to be believed must be seen, and which, when seen, fill one with astonishment that so much could have been effected in so short a time. The admirable address of the Hon. Abram S. Hewitt, President of the Institute of Mining Engineers, gives the reader some idea of the magnitude of two of the most important branches of industry in the United States—its mining and metallurgy—from the time when, in 1622, one hundred and fifty workmen were sent to the American colonies to erect ironworks, until to-day, when 2,108,000 tuns of iron represent the production of last year. Of every different mineral, indeed, except tin, the United States possesses, practically, unbounded resources; of coal the quantity is equally unlimited; of petroleum she alone possesses, as far as is now known, those strange and extended subterranean stores, the discovery of which created, not many years ago, so wild an excitement, and by which the whole world is supplied from some 3,600 wells in the State of Pennsylvania, and which furnish an average of about 24,000 barrels of oil daily. The Centennial Exhibition contains specimens of nearly all these sources of national wealth; and though they do not of themselves afford much information to the visitor, all information respecting them may be obtained, and the centers of the various industries visited; for though distances are great, the facilities for overcoming them are great also, and the inconveniences of travel in the United States are reduced to a minimum.

But manufactures of all kinds may be studied fully within the limits of the Exhibition itself, and the position attained by the United States to-day, in the production of woolen, cotton, and silk goods, would astonish many European manufacturers who look to a freedom from transatlantic monopoly for all time, notwithstanding that to-day the export of cotton goods from New York to Liverpool is considerable, if not at present very lucrative.

We have already referred to the admirable arrangements made for the benefit of visitors who wish to go to different parts of the country and study different industries. There never was an exhibition held at which so many facilities were offered in every direction, so many kindnesses shown, so much trouble taken, and, let us add, so much that would be worth seeing and studying, if the distances were not so magnificent. But so many thousand miles have to be traversed, and time for most visitors in Philadelphia is limited, while their duties unfortunately are not, that only a very small proportion of what should be seen can be visited, despite the opportunities afforded, and the universal anxiety to aid the stranger in every possible way.—*Engineering.*

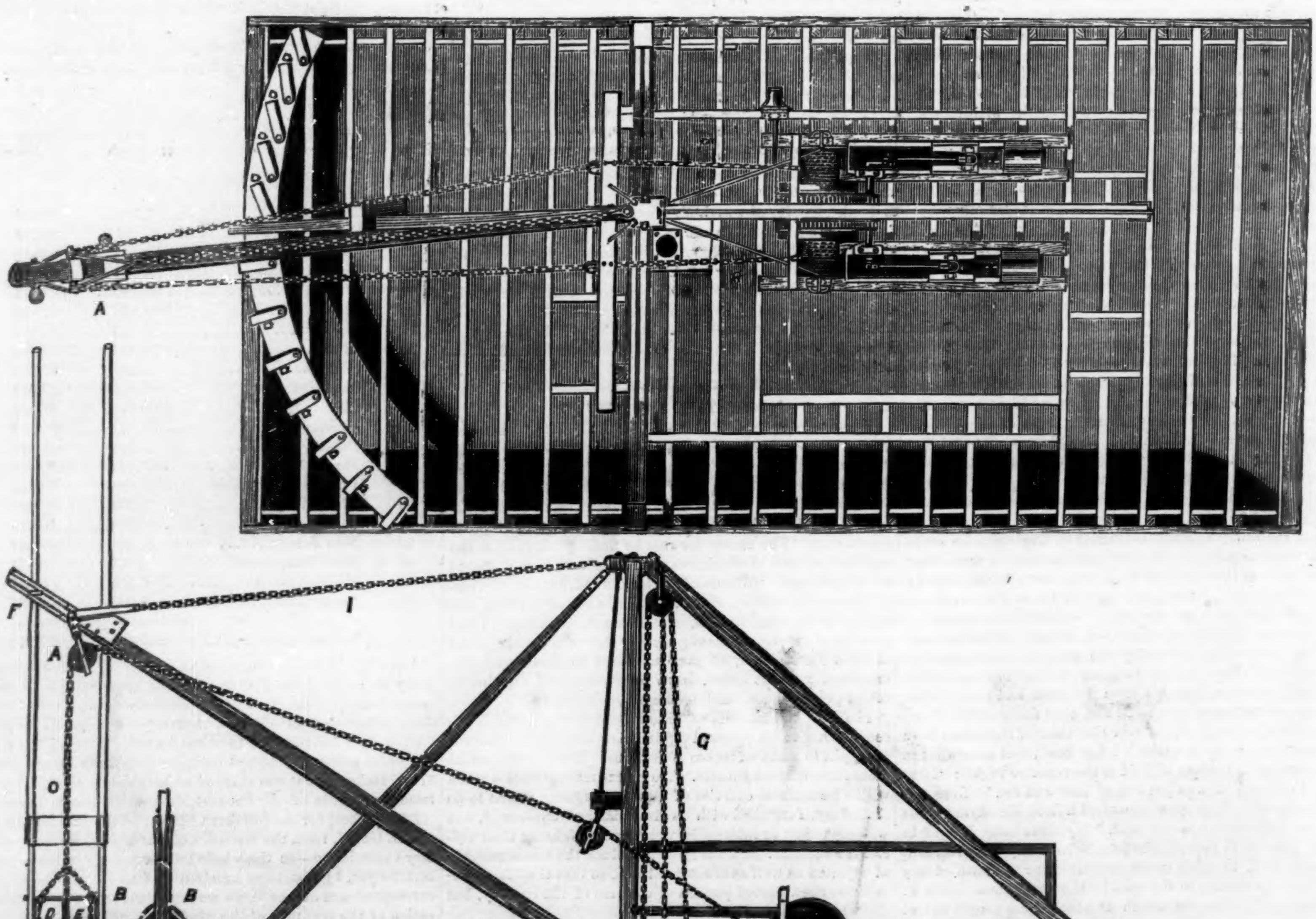
Wool Greasing.

A Mr. Lebrun mentions, in a German paper, that a considerable quantity of oil may be saved by the following process of oiling wool, besides insuring a more uniform and regular web, on account of the woolen fibers loosening and separating themselves more easily from each other. Moreover, this plan, it is said, is not open to the objectionable features of some processes, which sometimes cause the total disappearance of fine color dyes; and the cards wear longer and better, besides allowing the wool to be more easily and economically cleaned.

To obtain this preparative, pour into a wooden trough 20 parts oil, with 10 parts of liquid ammonia, adding 5 parts of water. Stir up this liquor with a wooden spoon, and, by inserting a steam pipe, allow the same to boil until the strong smell of ammonia has evaporated, after which the oiling or greasing may be proceeded with in the usual manner.

New Size for Cottons.

Haitra is procured from China and Japan, and may be used for thickening colors and sizing all tissues. For use it is washed in water and is then boiled with sixty times its weight of water, in a closed vessel, at 65° Fah. The paste thus obtained will keep, and adheres to the fiber so tenaciously that when once dry it cannot be removed with cold water.



NEW STEAM DREDGING MACHINE.

IMPROVED WOODWORKING MACHINERY.

A growing demand is noticed among manufacturers in wood for machines combining the functions of several different tools in one, thereby economizing space in the factory and capital in investment. These machines are, from the great range of work for which they are adapted, known as universal woodworkers.

In the manufacture of builders' material, sashes, doors, etc., as well as in the production of furniture, agricultural implements, railroad cars, patterns, etc., such machines are almost invaluable. Their true value, however, is based upon the ease with which they can be adjusted, and the facility with which the changes can be made for the different kinds of work.

The apparatus illustrated herewith combines all the features of the variety woodworkers and hand planers of the same manufacturers, with a complete molding and flooring machine. The essential features of the original Climer & Riley patent on woodworkers are all included, together with many novel and important improvements and labor-saving devices, originated by the makers.

The two sides of the machine are driven from one countershaft, which is so arranged as to convey the power to both sides simultaneously or separately, as the operator may desire. The double friction pulley on the countershaft is caused to come in contact with the driving pulleys for the cutterheads by means of two levers, one for each operator, by which he sets in motion or stops his side of the machine as he may desire. This method of obtaining independence of the combination is new and effective, as two operators can perform their work, one on each side, without either interfering with the duties of the other.

Upon the molding side, the moldings can be worked to eight inches in width, also narrow surfacing and flooring to eight inches in width. This side is furnished with a pair of powerfully geared and heavily weighted feed rollers, the motion of which can be instantly started or stopped, or given a quick or slow motion, as may be required. The inside and outside cutterheads can be swung to an angle, and have a vertical adjustment with the table to which they are attached. The under cutterhead is adjustable for different thicknesses of cut, and can be used for forming moldings on the under side of the stuff. This molding side is provided with the same features and adjustments for making accurate moldings as the molding machines of the same manufacturers, and is convenient of adjustment and adapted for simple or complicated moldings up to eight inches wide.

The primary design of the woodworker side is for dressing out of wind, and for trying up and squaring lumber. By the addition of various heads and fixtures necessary to each operation, it is rendered capable of rabbeting, jointing, beveling, gaining, chamfering, plowing, making glue joints, beading, raising panels, ripping, cross-cutting, tenoning, making circular, waved, and serpentine molding, and a great variety of work, practically limited only by the ingenuity of the operator.

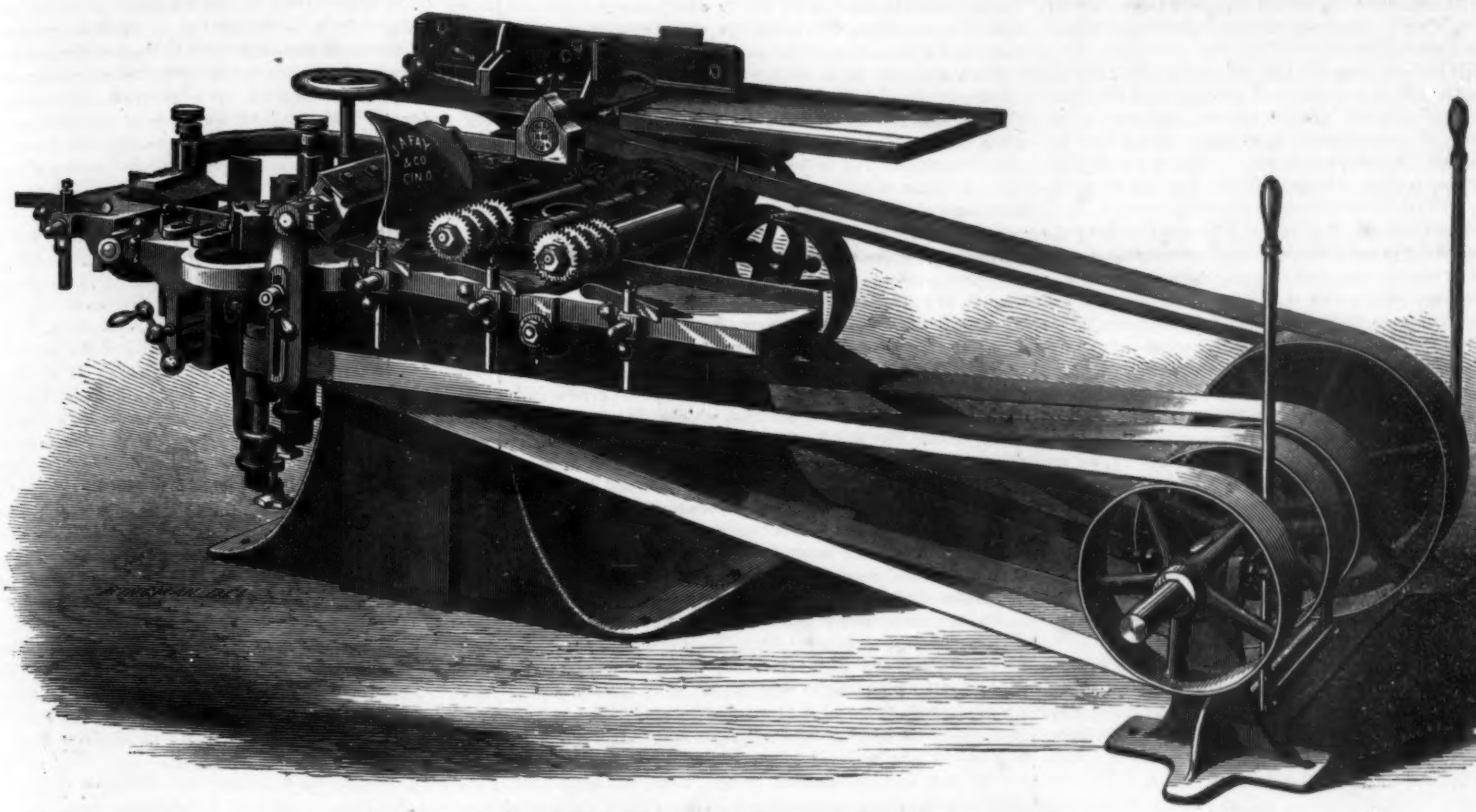
The whole machine has for its support a heavy iron column, upon which all the tables are planed and gibbed to move vertically, each having a separate adjustment. The woodworker tables have a horizontal adjustment for the accommodation of different sizes of heads and cutters, the vertical adjustment being used to graduate the depth of cut for grooving, gaining, panel raising, surfacing, etc.

One of the spindle bearings on the woodworker side is cast solidly to the column, the other being movable in a planed seat, and retained in its place by a screw. This outside bearing is readily removable to allow interchange of cutterheads on the spindle, and gives the spindle a steadiness not to be acquired where the head overhangs the framing of the machine.

The tables are furnished with grooves for receiving the gaining frame slide and other attachments, and for making a continuous table by fitting in slides of the proper form. The fence is attached to and moves with the forward table, can be adjusted to an angle of 45°, and is arranged to receive stud springs for holding down the lumber, and for bolting the panel-raising attachment.

The machine is very complete in all particulars, and the desirability of the combination can hardly be called in question. This machine can be seen in daily operation at the space of J. A. Fay & Co., Machinery Hall, Centennial Buildings, section B 8, columns 61, 62, 63. Any desired information will be furnished on application to the manufacturers, Cincinnati, Ohio.

[This description was published in our issue of August 19, the other engraving being, by an inadvertence, published therewith.—EDS.]



J. A. FAY & CO.'S UNIVERSAL WOOD WORKER.

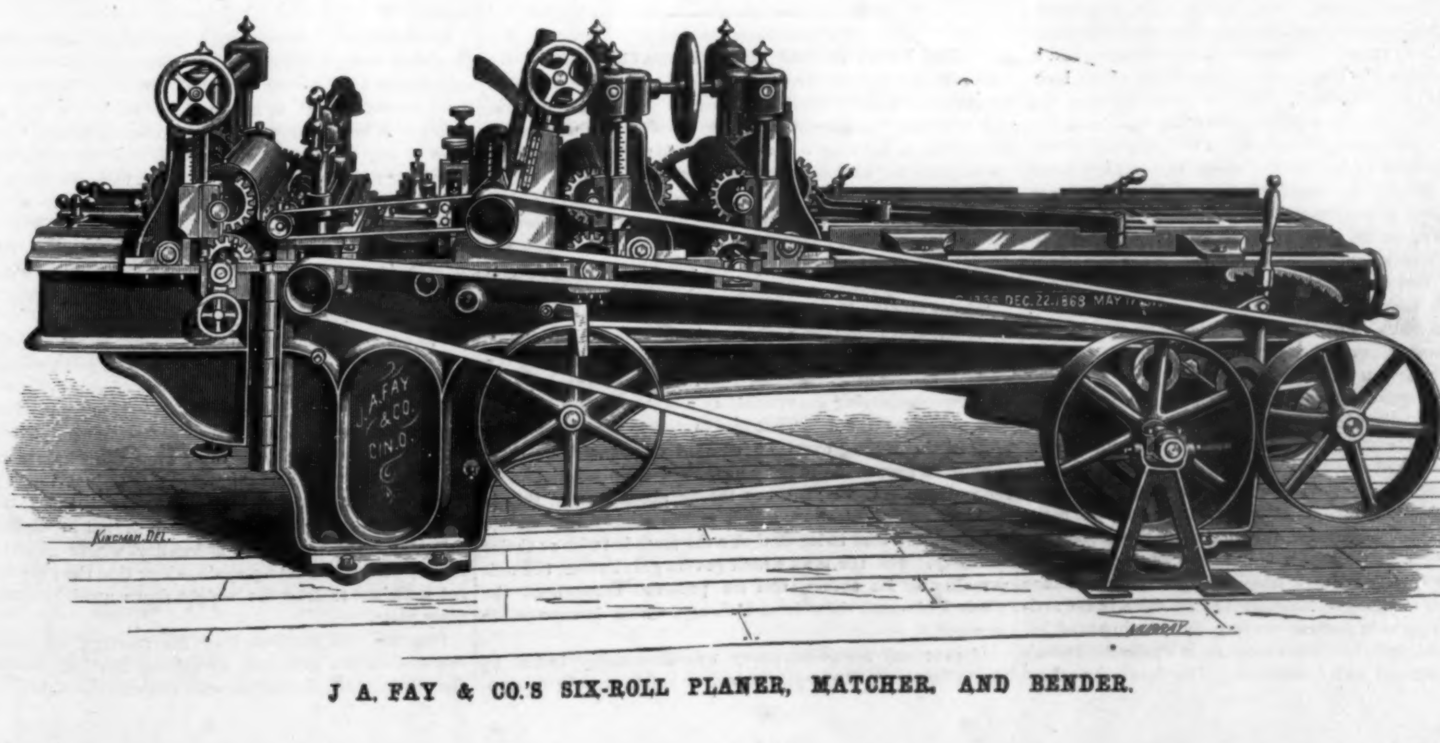
IMPROVED SIX-ROLL PLANER, MATCHER, AND BENDER.

Changes in machinery for working wood are so numerous and important in their effect on the trade that we feel justified in giving those who are interested in this class of tools the fullest opportunities of information in regard to any new machines of value which may be produced.

The machine herewith illustrated is manufactured by the well known wood tool builders, J. A. Fay & Co., of Cincinnati, Ohio. There are two cylinders, one for planing the upper surface of the board, and one for the under surface, each having two driving belts and three knives twenty-six inches in length, and being fitted with steel journals, and steel lips for chip breakers.

The two vertical sideheads are of gun metal, each having three cutters, and are adjustable for different widths of lumber to be jointed or tongued and grooved. They are also arranged to drop vertically below the bed to admit of surfacing the full width of the knives without removing the heads from their spindles.

The feeding mechanism consists of six rollers, six inches



J A. FAY & CO.'S SIX-ROLL PLANER, MATCHER, AND BENDER.

in diameter, in three pairs, connected by heavy expansion gearing at each end of the rolls. The rolls and upper cylinder can be elevated to take in lumber five inches in thickness. The upper rolls of the contiguous pairs are adjusted simultaneously by means of a hand wheel with geared connections.

The under cylinder is adjustable vertically for graduating the thickness of the cut, and is placed so that the discharging rollers carry the lumber from it. This is a novel and distinguishing feature of this planer, the rolls through which the lumber last passes being placed outside of the under cylinder and bending pressure bar, which is placed and adjusted over the under cylinder.

These rolls are usually placed in the machine so that the under cylinder does not commence cutting until the board has passed some distance through, and consequently a portion of the board must depend upon being driven over the under cylinder by the board following. This defect is obviated by the new position of the cylinder and the discharging rolls.

Accessibility to the under cylinder is facilitated by the method adopted of moving the discharging rolls by revolving the end of the machine supporting them upon a hinge in one side of the frame; and the pressure bar over the under cylinder, being revolved upon one of its supports, leaves the under cylinder entirely open for any purpose of adjustment the operator may desire. The side cutterheads, being adjacent to the under cylinder, can also be more readily adjusted by virtue of the position thus attained.

This arrangement is a very desirable one, and the end of the machine is claimed to lose none of its stability, as the supports are of the most permanent character, easy of access and attached or detached very quickly.

The lower roller on the movable end of the machine has a vertical movement to compensate for any changes in elevation of the under cylinder, and in order that a constant pressure may be retained upon the lumber by keeping the peripheries of the cylinder and roller in the same relative position.

One of the machines may be seen on exhibition in daily operation in Machinery Hall, section B 8, columns 61, 62, 63, Centennial Exhibition, Philadelphia, or further particulars can be obtained by addressing the manufacturers at Cincinnati, Ohio.

[For the Scientific American.]

THE EXHIBIT OF CORNELL UNIVERSITY AT THE CENTENNIAL.

In the account of technical schools recently published in the SCIENTIFIC AMERICAN, the exhibit of the mechanical engineering department of Cornell University was omitted, as the articles shown by this school are of such an interesting character as to warrant a separate description.

Cornell University, as most of your readers doubtless know, furnishes courses in almost every branch of learning; but the present notice must be confined to the practical part of the course in mechanical engineering. This course covers a period of 4 years, during which each student is required to work for 10 hours a week in the shop. Some of the results of this work are shown at the Centennial, and the visitor is not deterred from making a critical examination by notices that handling is forbidden, but, on the contrary, is invited to subject the articles to any test that he may desire. Some surface plates, placed upon a low table, are particularly inviting to the passing visitor, who can make one plate float upon the other, and, after working out the air between, can lift the pair by grasping the upper one. These surface plates are a regular article of manufacture at Cornell University, and are sold at such a reasonable price (10 cents a square inch) that it is a matter of surprise to find that they are not in great demand. The scholars also make steel triangles for the use of draftsmen, and these will be found very serviceable for nice work. Professor Sweet, who is in charge of the practical course at Cornell University, proposes to add, to the articles manufactured for sale, solid calipers, accurately ground to standard sizes, which will be as useful as the well known Whitworth gages, and much cheaper. A necessary machine in connection with this manufacture is an instrument for accurate measurement; and a measuring machine reaching to ten-thousandths of an inch has been made at the school. This is constructed on the general principle of Whitworth's measuring machine, but has some important improvements. The principle of the machine is the same as that of the sheet metal gage made by Brown & Sharp, in which the measuring points are brought together by a screw, and the fractions of the revolution are measured on a wheel attached to the screw. In the machine under consideration, the screw has a pitch of $\frac{1}{16}$ of an inch, and the wheel is divided into 625 equal parts, each of which measures a movement of $\frac{1}{10000}$ of an inch. In the use of a machine of this kind, it is found that, if several operators each measure the same article, adjusting the points by their judgment, their results will vary sensibly; and one of the improvements of the present machine consists in having the handle which moves the screw independent of it, being kept in contact by friction until the measuring point bears against the article to be measured, when it slips. Another important improvement over the Whitworth machine is the use of a short screw, and a nut of the same length. By this arrangement, the motion of the measuring point attached to the screw is only about an inch, but the other point is adjustable on a slide to any desired distance up to one foot, so that the range of the machine is for articles from $\frac{1}{10000}$ to 12 inches, varying by ten-thousandths. A steam engine, built by the students, from Professor Sweet's design, has several novel features The frame has three supports, the cylinder resting in a socket upon one, and being free to move under changes of temperature. The piston is made very long, and has a number of grooves, no packing being used. The piston rod passes through a grooved tube, without any packing, and the valve stem, also without packing, works through a plain brass tube of considerable length. The valve consists of two flat plates, accurately fitted to the valve seat and an upper plate, thus being perfectly balanced, and being made very thin, to obviate as far as possible the difficulties caused by unequal expansion. The governor is attached to the fly wheel, and is connected with the eccentric, which swings round a point near one edge, under the action of the governor. The effect of moving the eccentric is to change the amount and period of opening of port, while the lead remains practically constant. The eccentric acts on the valve stem through the medium of a bell crank lever, so as to equalize the cut-off at each end of the cylinder. The valve motion of this engine, it will be seen, is quite novel, and it may be illustrated and more fully explained on some future occasion. A model of the valve is shown, with a neat arrangement for tracing a diagram of its action. The crosshead of the engine is unusually long, and the connecting rod, instead of vibrating on the pin, is rigidly attached to it, and the pin moves in bearings on the crosshead. This arrangement greatly facilitates accurate adjustment. The crank pin works in cast iron boxes. The main bearings have considerable side play. It would be impossible, without illustration, to give a thorough explanation of the features which have been briefly enumerated. The design in building the engine was to give the students some idea of the requirements of a good engine. The result is a substantial machine, and one which will probably be serviceable as constructed at present, though it will be noticed that some of the details are experimental. It will be easy, however, to use packing, if it should be found necessary. The engine has a diameter of 6 inches and a stroke of 12, can be run at a speed of 300 revolutions a minute, and will be sold for $750.

If any of your readers is looking for a complete foot lathe he will do well to visit this exhibit. The amateur foot lathe made by the students, is the second that has been constructed at their shop, and seems to be as nearly perfect a machine of the kind as is usually met with. It has a 4 foot bed and 10 inch swing. There are three speed wheels for the driving belt, an internal back gear on the head stock, three friction feeds, and change wheels for cutting screws of 26 different pitches. The machine is adapted to all kinds of work that can be done on a lathe, straight and taper work, turning spheres, etc. The slide rest moves on one flat and one V way. There is an adjustment for a slight movement of the tool, such as may be required in screw cutting. One wrench fits all the nuts which must be loosened to make adjustments. Handles are fitted to all parts in which frequent changes are required. The rock shaft of the treadle motion works on knife edges, and requires no lubrication. On removing the foot from the treadle, it becomes detached from the pin of the connecting rod, and is caught and held up by a spring. There are drawers at the back of the machine for the extra wheels and tools. This machine is offered for sale at the very moderate price of $400. It is probable that it will be bought by some amateur who knows how to appreciate work of this kind.

The engine in this exhibit drives a Gramme machine, which has the power of a Grove battery of 100 cells. This machine was built by the students, from designs furnished by the Professor of Physics, and is, so far as the writer knows the only machine of the kind built in the United States. It furnishes power for several electric engines used by another exhibitor for driving a lathe, a sewing machine, and a mill, also for an electric light, and for burning wire. The machine has several ingenious adjustments or switches by which the direction and quality of the current can be changed, and it can also be used as an electric engine, driven by a battery.

Philadelphia, Pa. R. H. B.

[For the Scientific American.]

THE FACTS OF THE LAWS OF GRAVITATION.

The crucial test for the correctness of a scientific theory is the inquiry whether it will enable us to predict phenomena, and whether experiment or observation will verify every prediction. Recently a member of the French Academy stated that he had conceived a new theory of electricity, and was at once asked if it had enabled him to foresee phenomena, and if he had found practically the verification of his prediction. His answer was affirmative, but not as positively so as strict science requires, and his theory is therefore still an hypothesis.

Among all the scientific theories, there is none more firmly established than that which maintains the universality of gravitation, and establishes the laws governing it. We avoid speaking of a theory of gravitation, because we cannot help considering gravitation as a stubborn fact, and not as a mere speculation. That bodies fall to the ground, and after having falling exert an amount of pressure on their support in proportion to their mass, is a simple, universally recognized fact, without any theory about it; and this is what we call gravitation, which means simply that matter is heavy, and that twice or thrice the mass is twice or thrice as heavy. But the laws which govern gravitation, the universality of its action, and its presence throughout the whole Universe: these form a theory, which is susceptible to proof.

If ever any scientific theory was thoroughly tested, by predictions of phenomena expected under certain circumstances, it is this; and if ever any theory was fortified by the subsequent observation and verification of the predicted phenomena, it is this. It has been attacked in some quarters, even by persons of education, and doubts have been thrown upon its teachings. This was done by the great German poet and philosopher Goethe, among others; but he was simply ignorant of the facts. Every man judges about things according to the amount of information in his possession; and if Goethe had been informed of the manifold facts verifying this theory, he would surely never have attacked it. Unfortunately he did not know anything about mathematics, which is the science of the laws governing space and time, and therefore the key to all natural philosophy; neither had he ever received any training in practical observation and experiment, his large treatise on optics being a gigantic confession of ignorance of the subject, and also of his inability to draw correct conclusions from phenomena observed. He erred equally when treating of gravitation; he showed that he had not the least comprehension of the established theory, forgetting, as he did, that, in order to criticize anything thoroughly and successfully, we must first understand it well. Hence his strictures upon the Newtonian theory go for nothing, and have weight only among those who know as little about it as Goethe did; and their number is, unfortunately, not inconsiderable.

Newton tested his theory by the motion of the moon, and found that, if terrestrial gravitation (which is no theory, but a fact) extended to the moon, and diminished inversely as the square of the distance from the earth's center, it would, as the moon is at a mean distance of 60 terrestrial radii, be 60 x 60 or 3,600 times less in power on the moon. As a body on our earth falls nearly 16 feet in the first second, it would, at the distance of the moon, fall 3,600 times as slowly; and as an hour is 3,600 seconds, it would there fall in an hour no further than near the earth's surface in a second, so that the moon falls every hour 16 feet towards the earth. Comparing with this figure the tendency of the moon to move in a straight line, as is the natural property of all moving bodies, and the moon's consequent tendency to fly off in a straight tangent from its curved orbit, he found that, if terrestrial gravitation or attraction were withdrawn, she would in an hour be 16 feet further from the earth, this centrifugal force appearing exactly to counterbalance the terrestrial attraction at that distance, and proving that it really was 16 feet for the first hour: verifying thus the law that the attraction is inversely proportional to the square of the distance.

That this terrestrial attraction or gravitation was partially counteracted, even on the earth's surface, by the earth's rotation around its axis was proved by the fact that this attraction was stronger near the poles, where the circle of rotation is smaller and the velocity less, and weaker under the equator, where the circle is larger and the velocity greater; while in the latter case the centrifugal tendency is in a direction exactly opposite to that of gravitation, so that bodies weigh more at the poles than near the equator.

That the terrestrial attraction is not a property of the earth, but is diffused throughout all matter, so that all bodies attract all other bodies, was proved by the torsion balance of Coulomb, by which he proved that a heavy mass, suddenly brought before a small ball delicately suspended in a glass case, will attract the latter from its position; he even measured the amount of this attraction for masses of a given weight, and in this way came, by comparison, to the knowledge of the mass of our whole earth.

That the terrestrial gravitation is not concentrated in the earth's center, but a resultant of the sum total of all the individual attractions of every particle contained in it, is proved by the diminished gravitation when descending in a mine. If indeed the attraction solely resided in the center, it should increase when going down; but being a result of the attraction of the whole mass, the central attraction is counteracted by the attraction of all masses above the observer; and hence gravitation decreases with the depth, and if it were possible to reach the earth's center it would be found there to be zero, the attraction being balanced all round.

In Herschel's "Astronomy," published many years ago, an arrangement is suggested for observing the difference in gravitation on the earth's surface, by counteracting it by a force not dependent on gravitation, namely, a spiral steel spring. It is evident that, if we wish to ascertain whether a mass of say 1 lb. in weight, weighs less under the equator than near the poles, we must not use a 1 lb. weight as counterpoise, as this would be equally affected by the terrestrial attraction; but if we use a spring to suspend it from, we shall observe less tension in the spring on which the mass of 1 lb. is suspended when brought to a locality where the gravitation is less, as is the case under the equator, than it is at the poles.

The apparatus suggested by Herschel is but a rough contrivance, and only fit to show that there is a difference, and it is not adapted to measure the amount of this difference. It consists of a stand from which a spiral spring is suspended, to the lower end of which a weight is attached. The weight and spring are so arranged that, when the whole machine is placed perpendicularly, the weight will just touch a piece of glass plate, inserted in the base under it. If now this apparatus is carefully packed up so as not to disturb anything, and transported to a locality where gravitation is less, it will, when set up again, show that the gravitation is not sufficient to draw the weight down until it touches the glass plate.

Siemens has succeeded in constructing an apparatus, founded on this principle, so perfect that he can measure the diminished gravitation with sufficient accuracy to calcu-

late the distance from the earth when in a balloon; and not only this, but, as water is of less density than the earth, he can also calculate from its indications the depth of the ocean. Evidently the gravitation at the ocean's surface must decrease in proportion as the depth increases; because, when there is more water under the ship's bottom (water having less weight than earth) its attraction will be, proportionally to its mass, less. This instrument, which has been described in the SCIENTIFIC AMERICAN SUPPLEMENT (page 368, volume I), is thus constructed in entire accordance with the theory of the law of gravitation; and having been fully verified by experiment, it is an additional confirmation of this theory, of which the ultimate triumph is as complete as that of any theory in the whole field of Science.

New York city. P. H. VANDER WEYDE

[For the Scientific American.]

NICKEL AND ITS PREPARATION.

Nickel is not an abundant metal; and although it occurs in a dozen different ores, the number of localities where it it is found in paying quantities is very few. It is never found in a metallic state, except in meteorites. In ores, it is generally associated with iron and cobalt, both of which it resembles. The principal source of nickel is the native arsenide, a copper-colored mineral, called by the Germans *kupfer-nickel*, or false copper, because it contains no copper. This ore contains from 33 to 55 per cent of arsenic, 33 to 45 per cent of nickel, and small quantities of sulphur, iron, and other substances. Another compound of nickel and arsenic has received the name of cloanthite or white nickel. Annabergite, or nickel bloom, is a compound of arsenic acid with oxide of nickel, quite soft and of an apple green color. The most beautiful nickel mineral is the sulphide, or millerite. It has a brass yellow color and metallic luster, and usually occurs in capillary crystals, in the cavities and among the crystals of other minerals, hence called capillary pyrites In this country it is found chiefly in Lancaster county, Pa. The other nickel minerals are breithauptite, nickel glance, ullmanite, emerald nickel, pyromelin, grunanite, pimelite, garnierite, and noumeite. Speiss is a deposit formed in the pots in which roasted arsenide of cobalt, mixed with copper nickel, is fused with carbonate of potassium and quartz, for the preparation of smalt, in the blue color works; it collects below the blue glass, in the form of a metallic alloy, the nickel not oxidizing so easily in roasting as the cobalt. It is an important source of nickel

Of the metallurgy of nickel little is known outside of the works, which are carefully guarded, although it is difficult to see of what use a knowledge of a process could be to those who have no source of material at hand, or why those who have a monopoly of the ore need fear competition. Professor C. Küntzel has, however, published some interesting facts in regard to the method used in the metallurgy of nickel, from which we glean the following:

The preparation of metallic nickel and cobalt is sometimes conducted in the dry way, by collecting and concentrating the nickel, cobalt, and copper, in an arsenical or sulphur compound (*speise* or stone), while, at the same time, the iron in the ores is removed by scorification; the cobalt is afterwards fluxed with pure quartz sand, and the protoxide of cobalt precipitated, from the silicate of cobalt thus formed, by fusion with excess of carbonate of soda; the sulphur or arsenic is expelled from the *speise*, which has had the cobalt removed by roasting and heating with soda and saltpeter, and finally reduced with carbon. It is more frequently obtained in the wet way, by dissolving the nickel and cobalt ores in acids and separating the dissolved metals; but the greater part of the iron should first be removed and the nickel and cobalt concentrated before dissolving. In the dry method the first step is also to get rid of the iron in the ore or *speise*. The complete separation of iron from arsenical compounds of nickel and cobalt is not very difficult, for iron has much less affinity for arsenic than cobalt or nickel; but to separate it from the sulphides was, until recently, very difficult, if not impossible. The reason of this is that nickel and cobalt have nearly the same affinity for sulphur that iron has. This operation is now accomplished by smelting the rawferruginous ore in a reverberatory furnace, with a mixture of two parts of fine barytes and one part quartz sand; for 1 per cent of iron, 18 to 19 per cent of this flux is required. A fusible ferro-silicate of barium is formed and sulphurous acid driven out. In 1870, Dr. R. Wagner proposed to make use of the oxidizing action of Chili saltpeter for removing the iron, sulphur, and arsenic. For arsenical products, this method is inferior to the one generally employed, namely, roasting the metallic arsenides after the iron has been removed, then heating with saltpeter and soda. Wagner's method may be employed with advantage when it is desired to smelt a nickel ore, which has been freed from iron, with a metal free from sulphur, provided it contains enough copper to prevent the resulting metal from being too infusible.

The manufacture of nickel in the wet way varies with the material or source. The principal steps are the following: 1. Dissolving the roasted products in hydrochloric or sulphuric acids. 2. Precipitation of the iron by means of lime or carbonate of lime, or soda, after oxidizing, if necessary, with chlorine or chloride of lime. 3. Precipitation of the copper with sulphuretted hydrogen, or alkaline sulphides. 4. Precipitation of the cobalt as sesquioxide by means of chloride of lime. 5. Precipitation of the nickel as hydrated oxide or carbonate with milk of lime or carbonate of soda. 6. Igniting this precipitate so as to obtain anhydrous oxide of nickel, insoluble in dilute acids. 7. Leaching out the excess of lime and gypsum from the ignited oxide of nickel. 8. Reduction of the pure oxide of nickel by ignition with charcoal.

In dissolving nickel ore, care should be taken to prevent silica going into the nickel solution, for, on neutralizing the previously acid solution, all the silica is precipitated in the form of silicate of nickel. Sometimes in analyses a small quantity of silicic acid runs through all the operations, and there is no simpler method of removing it entirely at the start than by adding to the neutral solution some neutral nickel salt.

For precipitating the copper with sulphuretted hydrogen, Gerstenhoefer's precipitating tower, which was first employed at Freiburg to precipitate arsenic from sulphuric acid, may be employed. Such an apparatus avoids any escape of the gas, and precipitates the metals in the shortest possible time. The solution enters automatically at the top of the tower, which has an hydraulic seal. It falls, drop by drop, down into an atmosphere of sulphuretted hydrogen, passing from one platform to another: and if it does not contain too much copper, it passes out at the bottom free from copper. The gas, which is absorbed by the nickel solution, is expelled by heating it with steam. If a soda ash works is near, the waste sulphide of calcium may be employed with profit for precipitating the copper. Injury to the workmen from inhaling sulphuretted hydrogen can be prevented by the use of wine or spirits; sulphuretted hydrogen retards the circulation of the blood, which is neutralized by the property that alcohol has of accelerating the circulation.

Nitrite of potash cannot be employed to separate nickel and cobalt when there is lime in the solution. In this case it cannot even be used as a test; for in the presence of lime or other alkaline earth, a yellow precipitate is formed, similar to the nitrite of cobalt and potash, and said to have the composition $K_2\,Ca\,Ni\,(NO_2)_6$. If there is enough lime present, all the nickel is thrown down as a double nitrite.

Cobalt and nickel may be separated by means of sulphate of ammonia and sulphuric acid, if the quantity of cobalt is not too small relatively. The separation is quite exact if the solution is sufficiently concentrated. The nickel separates as a difficultly soluble double sulphate of nickel and ammonia, while the double salt of cobalt remains in solution. From the former the sulphate of ammonia is expelled by heating in clay pipes. The sulphate of nickel is almost entirely converted into oxide by roasting with charcoal; the last trace of sulphur is removed by igniting with soda and saltpeter.

The best method of removing the sulphate of lime is to extract the excess of lime added with hydrochloric acid water, then to boil the oxide with steam, and add slowly such a quantity of carbonate of soda that, after boiling a quarter of an hour, there is still an excess of the carbonate in the solution. Sulphate of soda and carbonate of lime are formed; the first is washed out with water, and the latter with water acidified with hydrochloric acid.

Oxide of nickel can be reduced at a bright red heat by simple contact with coarse broken charcoal. The reduction extends inwardly from the surface of the cubes. If left in contact with the carbon after it is entirely reduced, it absorbs more and more carbon. The reduction usually takes place on the clay crucibles on the hearth of a flame furnace. At Val Benoit, near Lüttich, a continuously working furnace is used, the reduction being accomplished in upright tubes. E. J. H.

[For the Scientific American.]

SCIENTIFIC APPARATUS.

At the loan exhibition of scientific apparatus, now open at the South Kensington Museum, London, free evening lectures are delivered on scientific subjects. The collection includes apparatus of the most primitive and ancient forms, with specimens of the successive improvements down to the present time. Many of these articles have a great personal interest, as associated with the names, labors, and discoveries of eminent scientific men, mechanicians, discoverers, and inventors. On a recent occasion, the lecturer, Mr. Chandler Roberts, F.R.S., chemist of the mint, took for his theme: "The Apparatus Employed in the Researches of the late Master of the Mint, Mr. Graham." The name of Thomas Graham is well known as the author of "Elements of Chemistry" His scientific papers, published in the transaction of societies, range in date from 1834 down to 1869, the year of his death

The lecturer, with specimens of apparatus before him, both that of Mr. Graham and of others, gave a very interesting discourse. In its scientific aspects, and in its comparison of the processes followed, the reasoning employed, and the results obtained, the lecture was very interesting. But there is another respect in which the lecture has a general interest, as demonstrating that the essential apparatus for scientific researches is found in the mind, the memory, the power of analysis and comparison, in the ingenious adaptation of means and implements. in a word, in the genius of the discoverer.

Mr. Roberts concluded his lecture by saying that, although for delicate researches or measurements complicated instruments are necessary, still the most ordinary appliances, in the hands of a man of genius. are capable of yielding very important results. With a glass tube and a plug of plaster of Paris, Mr. Graham discovered and verified the law of the diffusion of gases. With a tobacco pipe, he gave additional evidence that atmospheric air is a mechanical mixture of its constituent gases. By the aid of a tambourine and a basin of water, he divided bodies into crystalloids and colloids, and obtained silicic acid, and oxide of iron soluble in water. With a toy balloon of india rubber, filled with carbonic acid gas, he separated oxygen from atmospheric air, and developed points, the importance of which it is impossible to overrate from a physiological point of view. By the expansion of a wire which attended its absorption of a gas, he did much to prove that hydrogen is the gas of a white metal.

Such facts as these are of great interest to mechanics and operative chemists, whose daily occupation is the proof of mechanical and scientific discoveries, the application of laws and facts already discovered. Their daily employment is suggestive; and if they have active minds and patient habits of observation, there are frequent chances for testing the value of their thoughts and the possibilities of improvements in machinery and processes. "If" they had only such and such tools, or apparatus! The "if" must be met as Thomas Graham met it. *

Liquid Indicator.

Dr. Siemens has designed an instrument by which a stream of alcohol and water mixed in any proportion is measured in such a manner that one train of counter wheels records the volume of the mixed liquor, while a second counter gives a true record of the amount of alcohol contained in it. The principle on which this measuring apparatus acts may be shortly described thus: The volume of liquid is passed through a revolving drum, divided into three compartments by radial divisions, and not dissimilar in appearance to an ordinary wet gas meter; the revolutions of this drum produce a record of the total volume of passing liquid. The liquid, on its way to the measuring drum, passes through a receiver containing a float of thin metal filled with proof spirit, which float is partially supported by means of a carefully adjusted spring, and its position determines that of a lever, the angular position of which causes the alcohol counter to rotate more or less for every revolution of the measuring drum. Thus, if water only passes through the apparatus, the lever in question stands at its lowest position, when the rotation motion of the drum will not be communicated to the alcohol counter; but in proportion as the lever ascends, a greater proportion of the motion of the drum will be communicated to the alcohol counter, and this motion is rendered strictly proportionate to the alcohol contained in the liquid, allowance being made in the instrument for the change of volume due to chemical affinity between the two liquids. Several thousand instruments of this description are employed by the Russian government in controlling the production of spirits in that empire, whereby a large staff of officials is saved, and a perfectly just and technically unobjectionable method is established for levying the excise dues.—*Nature.*

Naval Items.

REDUCTION OF PAY AND MEN.

"Abstract of general order No. 216, dated August 12, 1876: The estimates made for pay of the navy for the current year were $7,600,000. Congress, however, determined that by a very rigid enforcement of a somewhat disused power on the part of the secretary of the navy to furlough officers, instead of having them under the heads of "other duty" or "waiting orders," a very considerable reduction could be made; and appropriated for the current year, for the pay of the navy to be administered upon this plan, and also reduced by cutting off 1,000 from its former complement of 8,500 men, the sum of $5,750,000, or nearly $2,000,000 less than the amount of the estimates. Under these circumstances, the department, although entertaining different views, feels bound to make, in good faith, the effort to bring the actual expenses of this branch of the service as near as possible to the amount appropriated by Congress. This can only be done by reducing the number of officers employed, to those absolutely needed to meet the daily pressing requirements of the service, and by putting those unemployed upon the lowest pay recognized by the provisions of existing laws.

"It is therefore ordered that: Until further orders, all officers not on duty on September 1 next, and all on leave, will, at the expiration of leave or waiting orders, be regarded as on furlough, and will be so paid.

"The foregoing applies only to the active list of the navy, the pay of retired officers being fixed by special provision of law."

NAVAL ENGINEER CORPS GAZETTE.

Chief Engineer James B. Kimball, detached from the U. S. steamer Hartford, and as Fleet Engineer of the North Atlantic Station, and placed on waiting orders.

Chief Engineer A. J. Kiersted, detached from the U. S. steamer Vandalia, and ordered to the Hartford, and also to discharge the duties of Fleet Engineer of the North Atlantic Station.

Chief Engineer Joseph Trilley to the Vandalia.

Cadet Engineer George S. Willits, detached from the Vandalia and placed on waiting orders.

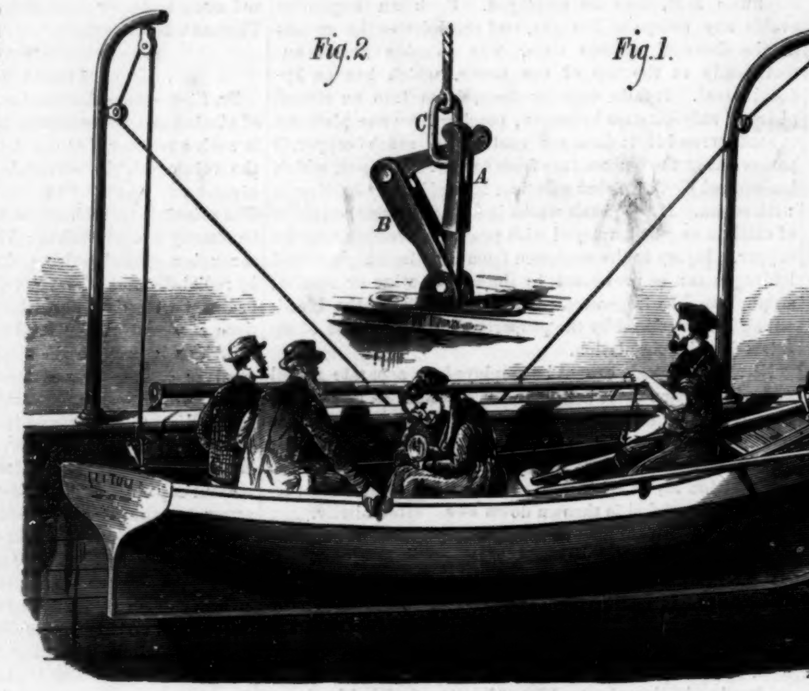
A Panic among Sponge Divers.

Mr. Vice-Consul Jago, writing from Beyrout, says that the last crop of Turkey sponge was very deficient, and prices of ordinary and common sponges have greatly risen in consequence. The deficiency is attributed to a panic among the divers, caused by the appearance in the neighborhood of Batroun, Mount Lebanon, the chief sponge fishing locality, of a sea monster, alleged to have been equal in size to a small boat. Its actual depredations among the divers appear at the present time to have been limited to one man, whom he is said to have swallowed whole.

A SQUARE of 208·72 feet each way covers one acre, so also does a circle 235·5 feet in diameter.

IMPROVED BOAT-LOWERING APPARATUS.

We illustrate herewith a new boat-lowering apparatus, in which the inventor seeks to use the buoyancy of the boat as a means of detaching it from the falls. He has contrived the hooks, whereby the latter is fastened, so that they will open when the weight of the boat is taken by the water. The release is thus automatically effected. In order to secure the even lowering of the boat, the inboard ends of the falls are wound about a drum bolted alongside the bulwarks, and the rotation of the drum is governed by a pawl and ratchet or other simple mechanism. The hook which forms the essential feature of the invention is illustrated in Fig. 2. It consists of three parts two of which, A and B, are pivoted in lugs attached to the boat, and a third, C, is pivoted to one of the aforesaid parts, and enters a slot in the other. Over the part, C, the ring at the end of the fall passes; and so long as there is any weight suspended by the hook, its parts will maintain their relative position as shown in Fig. 2. When, however, the stress of the weight is removed, the part, C, falls from the upper portion of the slot where it engages by the shoulder formed upon it, and is drawn out by the part, B, which falls flat, the part, A, doing likewise. The falls are thus instantly released, leaving the boat free. To hook the boat on for hoisting, it is simply necessary to insert the part, C, through the ring, and catch it in the slot. The parts are then held together until the weight of the boat rests on the hook, when no further attention is required. The inventor provides a safety cord, which, as the boat descends, comes out of the hole at the end of the small hook. This is intended to prevent all danger of the boat being lifted accidentally, and so released before the proper time. Fig. 1 shows the invention complete, as attached to a boat.



BRICE'S BOAT LOWERING APPARATUS.

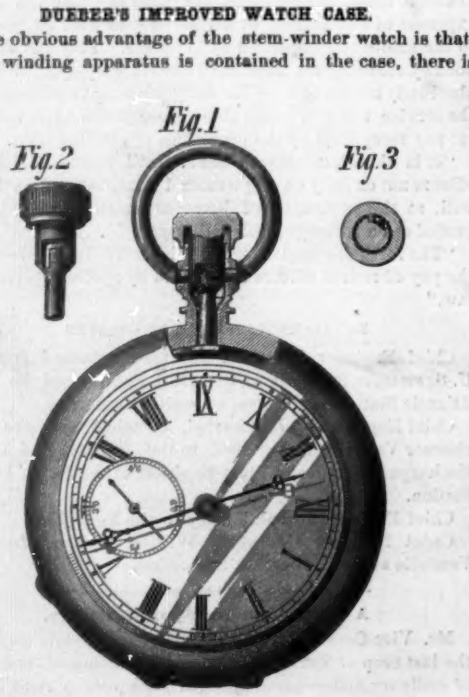
Patents pending through the Scientific American Patent Agency in this country, Great Britain, and France.

Mr. W. C. Brice has also invented an actinometer, or photographic testing plate, to be applied to a camera, for the purpose of determining the quality of the chemicals employed, and for discovering where the trouble lies in foggy and undefined pictures. It consists of a frame with a sliding glass, to which are applied fixed pieces of transparent material, superposed in layers in regular succession, to produce a graduated obstacle to the passage of light. Patents have been applied for on this improvement in the United States and several countries of Europe.

For further particulars address the inventor, W. Alexander Brice, care R. C. Poulter, 4a Middle Temple Lane, London, England.

DUEBER'S IMPROVED WATCH CASE.

The obvious advantage of the stem-winder watch is that, as its winding apparatus is contained in the case, there is



no necessity for carrying a separate key. But many consider that the annoyance of lost or mislaid keys is of less importance than the liability of stem winders to get out of repair and their higher first cost, so that probably the majority of people prefer the older-fashioned system.

In the invention herewith illustrated, the object sought has been to combine a key with the case, making it form a part thereof in the place where the stem-winding apparatus is usually located. The key, however, is detachable, and is used to wind the watch in the ordinary way.

In the engraving the key, Fig. 2, is shown inserted in Fig. 1. A small projection inside the pendant enters slots cut in the side of the key, as represented in Fig. 3, and hold it in place. It suffices, in order to remove the key, to push it in and turn to the left; the reverse operation re-fastens it in place.

It is claimed that this arrangement involves but very little extra cost, and that the key cannot get lost misplaced, or filled with dirt.

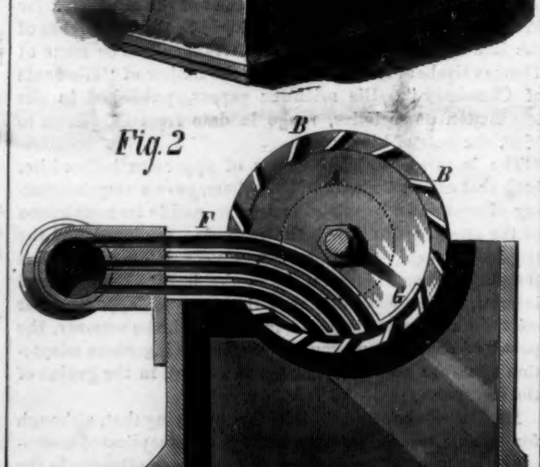
For further information address the Dueber Watch Case Manufacturing Company, 175 West Fourth street, Cincinnati, Ohio.

IMPROVED WATER MOTOR.

The invention herewith illustrated applies water to a wheel of a novel construction, whereby the whole centrifugal force of a jet of water is concentrated on the center of the buckets From these it is immediately discharged, thus avoiding any friction or dead lift, and imparting to the wheel not

Fig. 1

Fig. 2



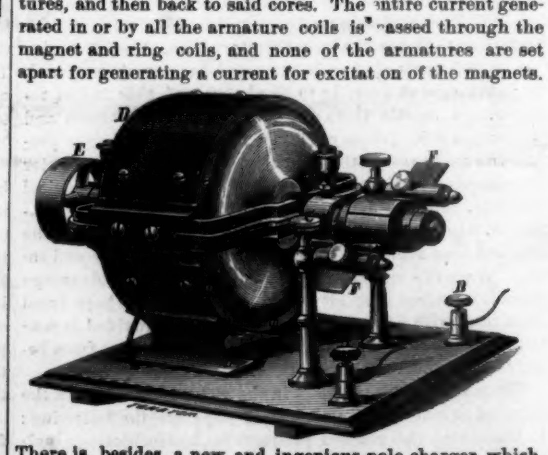
only a greater impetus but, it is claimed, a very high degree of power, considering the pressure and the size of the stream used. Although adapted to all purposes where water is used as a motive power, this invention is more particularly designed for use where the supply of water is limited or variable; and this is believed to be a desideratum, as streams of water are liable to much fluctuation at different seasons of the year. More especially is it designed for use in propelling light machinery, such as printing presses, sewing machines, lathes, etc., wherever water can be taken from a hydrant. It is also claimed to be well adapted for heavy work.

The disk of the wheel, A, Fig. 1, is made of brass of various sizes, and, together with the buckets, B B, is of a peculiar construction and of a capacity to correspond with the size of the stream and the power required. C C are the belt pulleys; D the supply pipe; E a self-packing faucet or stopcock, which is the subject of another patent obtained by the same inventor. This faucet is capable of supplying one, two, three, or more streams of water of different dimensions through the pipes, F, which are firmly held in position at the point of delivery of the water on the buckets by a shoe, G. The pipes are provided with bushings at their extremity, which can be removed at pleasure, and others of a different capacity inserted. The waste pipe, of course, can be arranged as required, either from the sides or bottom of the casing. The communication between supply pipe and buckets is shown in section in Fig. 2. Patented June 13, 1876. For further particulars address the Little Giant Water Motor and Self-Packing Faucet Company, Glen's Falls, Warren county, N. Y., Frederick J. P Chitty, manager.

THE WESTON DYNAMO-ELECTRIC MACHINE.

Our engraving represents a new electric machine, adapted more especially for electroplating. It is of simple construction and, we are informed, requires very little power. The illustration gives an exterior view; the mechanism is as follows: From the interior of an iron ring or cylinder, a number of radial magnets point to a common center. These, as well as the ring, are wound with wire. In the central space is a shaft which carries a series of armatures, the outwardly projecting ends of which are so arranged as, when reversed, to approximate closely to the extremities of the magnets. When the armatures are thus rapidly carried past the magnets, currents of electricity are induced in the wires surrounding said armatures. Instead of making the commutators with as many springs or brushes as there are insulated strips to connect their currents—a cause of loss and of frequent readjustment—a device is provided in which all the strips which convey currents of like kinds are united in the commutator itself, and it is only necessary to use the springs or brushes to collect the currents from all the armatures, no matter how many magnets or armatures may be employed. Only two springs or brushes are used, one being always in connection with one of the projecting pieces of one half the commutator, while the other is always in connection with the other half. Hence one transmits the positive and the other the negative currents.

When the machine is set in motion, a current is produced which flows through the halves of the commutator, then passes through wires to the coils which surround the magnets, and through the coils surrounding the iron ring. This circuit, small at first, rapidly excites the magnets, producing the maximum effect. The current is then led through any desired circuit and is returned to the machine through a spring into one half of the commutator, then into the other, completing the circuit from the coils surrounding the armatures, and then back to said cores. The entire current generated in or by all the armature coils is passed through the magnet and ring coils, and none of the armatures are set apart for generating a current for excitation of the magnets.



There is, besides, a new and ingenious pole charger which prevents the currents being changed during periods of rest, so that no preliminary examination of the currents is necessary before at once setting the apparatus in operation.

Four sizes of the machine are made, and one of medium dimensions is capable of running 200 gallons of nickel solution. The apparatus will be found at the Centennial, at west end of Corliss engine avenue, B 78. Patented by Edward Weston, July 18, 1876. For further particulars address Condit, Hanson, & Van Winkle, 236 Market street, Newark, N. J.

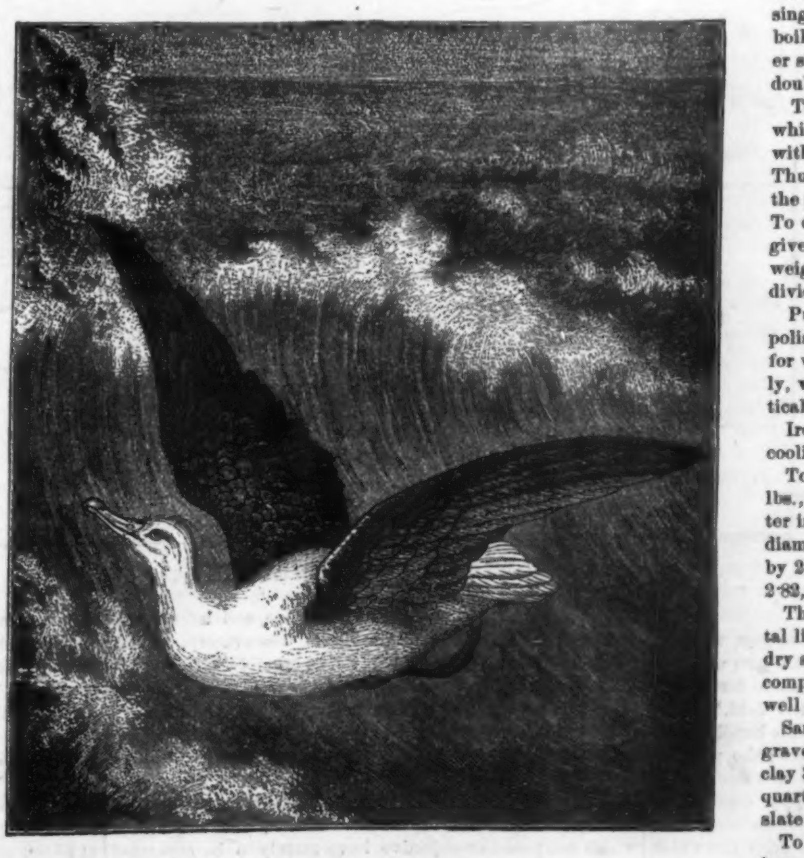
OCEANIC BIRDS.

The sub-family of web-footed oceanic birds known to zoölogists as the *procellarinæ* contains several *genera*, the best known of which are *procellaria* or petrel proper, and *thalassidroma* or stormy petrel. The name petrel is derived from Peter, in remembrance of the apostle's walking on the water, a characteristic of the bird excellently shown in the first of our two engravings. The birds here shown, commonly called by sailors Mother Carey's chickens, are readily distinguished from the common petrel by the shorter and slenderer bill. The species are about twelve in number, and inhabit the oceans of both hemispheres, skimming lightly over the waves or running along their tops; they are dark in color, but more or less marked with white. The Mother Carey's chicken (*thalassidroma pelagica*) is about six inches long in the body, with wings opening to a width of over thirteen inches; the bill and feet are black; the body is grayish, black above, tinged with brown. The presence of these birds is supposed by mariners to forebode stormy weather, and they are never molested by sailors, as their warnings are usually accepted in perfect faith; they are found all across the Atlantic, especially in the temperate zone, and are common on the banks of Newfoundland. They breed on rocky shores and islands, in the North Atlantic.

On the Shetland Isles, Scotland, they begin to lay toward the end of June, depositing a single egg in a nest made of plants and earth, which they carefully conceal, sometimes placing it three or four feet under a heap of stones. The naturalist Brünnich states that these birds become so fat that the inhabitants of the Faroe islands attach wicks to them and burn them as lamps.

Our second engraving represents another of the tireless wanderers of the deep, the albatross, also of a web-footed genus. Three species are known—the common albatross (*diomeda exulans*), the albatross of China (*diomeda fuliginosa*), and the yellow and black beaked albatross (*diomeda chlororynchos*). The first is the species chosen by the artist for representation; it is also called the man of war bird. The genus is distinguished principally by a very strong, hard, straight beak, which suddenly curves downwards, with a sharp hook at the point. The feet are short, the three toes long and completely webbed, the wings long and narrow. The common albatross is the largest sea bird known, weighing from twelve to twenty-eight lbs. Its wings measure, when extended, about eleven feet across; but a specimen, measuring seventeen and a half feet was shot off the Cape of Good Hope. The top of its head is of a ruddy gray, all the rest of its plumage, with the exception of some black bands on its back and a few wing feathers, being white. It is abundant from the Southern Ocean to as far north as Kamschatka, but scarcely ever visits our coasts. Its voracity is extreme, its ordinary food being fish and fish spawn; it can readily be caught, however, with a strong line and a hook baited with a piece of fat pork. Its powers of flight are very remarkable; and its voice is harsh and disagreeable, resembling the braying of an ass. The albatross is regarded with superstitious awe by sailors; and the killing of one is believed to bring down disasters on the ship.

THE STORMY PETREL.



THE ALBATROSS.

Suggestions about Breeding Cattle, etc.

1. A perfect development and sound vigorous health, constitutionally, especially in the generative organs, are conditions of fertility.

2. In the maintenance and improvement of a breed, the truth that "like produces like," that the reproductive germ will stamp upon the animal developed from it the characters of the parent organisms, is the backbone of success.

3. We can, in a great degree, at will, produce variations and improvements in breeds, as by abundant feeding, a mild and salubrious climate, a rich and healthy soil, moderate use, education, stimulation, or selection of desirable qualities; by disease or rejection of undesirable characters and properties; by soliciting the weight of imagination in our favor; by allowing the breeding animals to mix only with those of the stamp desired; by crossing less improved breeds systematically with mates of a better race, and by crossing animals faulty or deficient in some particular point with others, in which this point is developed in excess.

4. The herding of pregnant high-class animals with low-bred ones, and the resulting attachment between the two races, are to be especially avoided, as occasionally affecting the progeny injuriously; strong impressions from a new or unusual condition of surrounding objects are to be equally guarded against.

5 If a valuable female is allowed to breed to an inferior male, she cannot be relied upon to produce pure-bred animals for several succeeding pregnancies. Through a strong and retained impression, through the absorption into the system of living particles (germinal matter) from the fœtus, or through some influence, during pregnancy, on the ova, then being most actively developed, the good or bad features of the first sire are perpetuated in the progeny of succeeding ones.

6. All breeds show a tendency to breed back, or to produce offspring bearing the marks of their less improved and comparatively valueless ancestors; hence, individuals of this kind must be rejected from the best breeds if we would maintain their excellence.

7. Certain races and individuals have their characters more fixed, and will transmit and perpetuate them in greater proportion than others with which they may be crossed. If their qualities are desirable, they prove highly valuable in raising other stock of greater excellence. If undesirable, they will depreciate the value of any stock crossed for many generations. That fixity of type, however, is, above all, a characteristic of those which have been carefully selected and bred up to a certain standard for many generations, so that, in our best, longest established, and most esteemed breeds, we have a most valuable legacy left us by the successful breeders of the past, with which we may mold our inferior races almost at will.

8. While breeding continuously from the nearest relations tends to a weakened constitution, and the aggravation of any taint in the blood to sterility, these may be avoided by infusing at intervals fresh blood of the same family which has been bred apart from the branch of it for several generations. Moreover, the highest excellence is sometimes at tained only by breeding very close for a time.

9. Diseased or mutilated animals are generally to be discarded from breeding. Mutilations resulting from disease during pregnancy, and disease with a constitutional morbid taint are, above all, to be dreaded as transmissible.—*Professor James Law.*

Laying the First Cables of the East River.

New York and Brooklyn are at last joined together. The bond is a frail one at present, being only two ⅞-inch wire ropes stretched from tower to tower of the future East River bridge, but it is the beginning of the great superstructure, marking the first step in the second portion of the enterprise, and the substantial completion of the vast stone monuments which form the foundation for the whole. The two cables, each 3,600 feet long, were made fast near the Brooklyn anchorage, drawn up over the top of the pier, and then lowered to a scow, which carried the ends over to the New York side, the slack being paid into the river. A hemp rope, leading from a drum on a small engine, and previously brought over the New York tower, was made fast to the end of one cable, which was thus hauled over the pier until said end could be attached to a larger engine. The latter then hauled the cable taut and to an altitude of 180 feet above the river. The second cable was then raised in similar manner.

The work occupied five hours, and was witnessed by a large number of people. The cables will next be stretched from the towers to the respective anchorages, and all will then be joined together to form an endless chain, by means of which the material used in the construction of both the temporary and the permanent bridges will be transported across the river.

Facts and Simple Formulæ for Mechanics, Farmers, and Engineers.

The following are fair approximate rules for the power required to drive cotton machinery: Cotton openers, 1 horse power per 1,000 lbs. of cotton delivered; cotton pickers, 3 horse power per 1,000 lbs. of cotton delivered; cotton cards, $\frac{1}{15}$ horse power per lb. of cotton delivered per day, and, at 125 revolutions per minute, 0·125 horse power; railway heads, breakers, 1 horse power per each 10 yards per minute; railway heads, finishers, 0·001 horse power per revolution per minute; drawing frames, 0·002 horse power per revolution per minute; spindles, 0·005 horse power per spindle per 1,000 revolutions.

To find the safe pressure a cylindrical boiler will bear in lbs. per square inch: Divide the thickness of the plate in inches by the diameter of the boiler in inches, and multiply the quotient by 5,000 for a copper boiler with single riveted shell; by 6,400 for a copper boiler with double riveted shell; by 7,600 for a wrought iron boiler with single riveted shell; by 9,000 for a wrought iron boiler double riveted; by 10,000 for a steel boiler single riveted; by 12,000 for a steel boiler double riveted.

To determine the amount of coal in lbs. which will be burned per square foot per hour with chimneys of good proportions, Professor Thurston's rule is to subtract 1 from twice the square root of the hight of the chimney. To determine the hight of chimney required to give a certain rate of combustion, add 1 to the weight to be burned per square foot per hour; divide by 2 and square the quotient.

Pulleys covered with leather, iron pulleys polished, and mahogany pulleys polished, rank for working value as 36, 24, and 25, respectively, wood and iron uncovered being almost identical.

Iron castings shrink $\frac{1}{16}$ inch to the foot in cooling in the mold.

To find the weight of pipe per lineal foot in lbs., subtract the square of the inside diameter in inches from the square of the outside diameter in inches, and multiply for cast iron by 2·45, for wrought iron by 2·64, brass by 2·82, copper by 3·03, lead by 3·86.

The natural slopes of earths, with horizontal line, are as follows: Gravel (average) 40°, dry sand 38°, sand 22°, vegetable earth 28°, compact earth 50°, shingle 39°, rubble 45°, clay well drained 45°, clay wet 16°.

Sand weighs about 30 cwt. per cubic yard. gravel the same; mud 25 cwt., marl 26 cwt., clay 31 cwt., sandstone 39 cwt., shale 40 cwt., quartz 41 cwt., granite 42 cwt., trap the same, slate 43 cwt.

To true a carpenter's grindstone, use a ⅞-inch bar of iron or a gas pipe, for a turning tool, holding it below the center of the stone.

Chipping hammers should weigh about 1½ lbs. and have handles 15 inches long.

A 6 inch emery wheel should make about 2,400 revolutions per minute, an 8 inch 1,800, a 12 inch 1,200.

The pressure in lbs. per square foot of water acting against a plane surface at right angles to the direction of movement is 0·976 times the square of the velocity in feet per second

BREECH-LOADING FIREARMS.*

We herewith publish the second of a series of three classes of breech-loaders, the illustrations of which are selected from Mr. E. H. Knight's "American Mechanical Dictionary." The arms shown were recommended by the U. S. army commission in 1878.

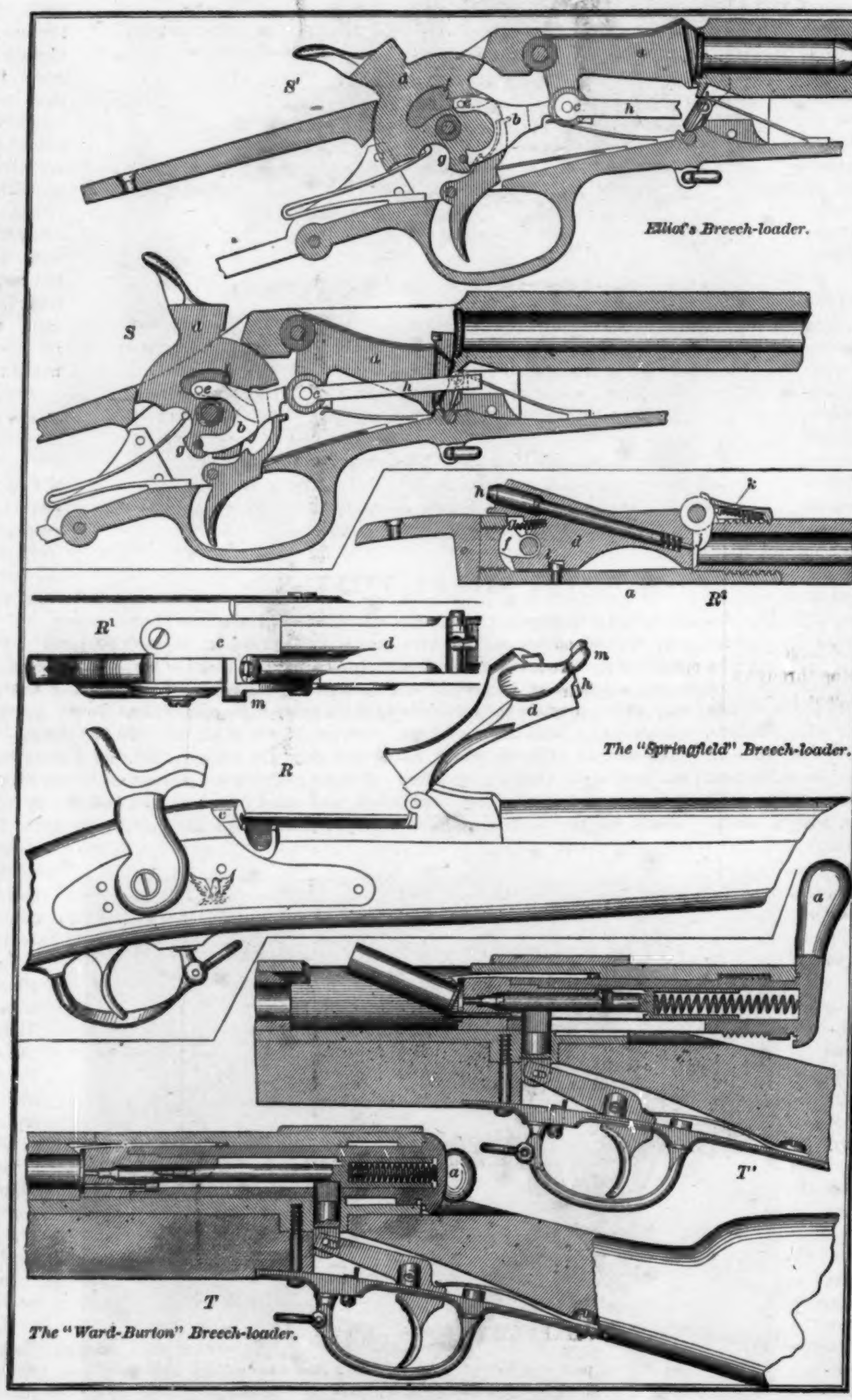
In the engravings, R, is the Springfield arm, having a breech block hinged to the upper edge of the barrel and swinging upward and forward. The indorsement of the board as the best, all things considered, entitles it to an honorable place in the series of examples. R is a side view of the gun, with the breech block, *d*, thrown up: *a* is the bottom of the receiver, *c* the breech pin, with its circular recess to receive the cam latch, *f*, which locks the breech block in place; *g* is the cam latch spring, *h* is the firing pin, which transmits the blow of the hammer to the priming of the cartridge, and is pressed back by a spiral spring after the delivery of the blow; *j* is the cartridge shell ejector, *k* its spring; *l* an incline which tips up the ejected shell so as to throw it out of the receiver. R¹ is a top view of the gun with block closed. R² is a section with the breech block closed. The dotted lines show the block raised.

The breech block is raised upward and forward in the act of opening by a thumb piece, *m*, which releases it by turning up the cam latch out of its recess in the breech pin. When fully open, it discloses the chamber, or rear end of the barrel, ready for the insertion of the charge contained in a copper cartridge case, holding seventy grains of musket powder, and firing a bullet $\frac{45}{100}$ of an inch in diameter and weighing about 400 grains. When the breech block is closed, it is held down and braced against the effort of the heaviest charges by the cam latch, which flies into place in closing. The piece is fired by the ordinary side lock taken from the old muzzle-loaders. In opening the piece after firing, the breech block strikes the lump on top of the extractor, and revolves it so as to carry the now empty cartridge shell to the rear. After passing a certain point, the spiral spring in front of the extractor is released, and accelerates its motion, so that the cartridge is thrown sharply against the beveled surface of the ejector stud, by which it is deflected upward and expelled from the gun.

S S′ are two views of the Elliot carbine recommended by the same board for trial in the field, as exhibiting "remarkable facility of manipulation in requiring but one hand to work it." This arm has a breech block hinged to the breech pin and operated by the hammer. Fig. S shows the gun in loading position and S′ in the position "ready to fire." After firing, the hammer, *d*, is pulled back to the position shown in S, and in so doing draws by the yoke, *b*, upon the breech block, *a*, to which it is pivoted at *c*. This pulls down the front end of the breech block, exposing the rear of the barrel for the insertion of the cartridge. Having done this work, the pin, *e*, of the yoke slips out of the socket, *f*, into the lower portion of the groove, while the lower branch of the yoke engages over the pin, *g*, so that, when the hammer is again pulled back, the breech block is pushed up again into the position shown at S′, where the hammer is on full cock and the arm ready to fire; *h* is a strap which works the retractor, so that the shell is ejected as the breech block is pulled down. S shows the cartridge ejector pulled out; S″ shows it in its bed. One pull on the hammer depresses the breech block and ejects the empty shell; another pull closes the breech block and puts the hammer in position for firing; a pull on the trigger fires the arm.

T T′ are two positions of the Ward-Burton gun, which is on the bolt principle, like the Prussian needle gun and the French Chassepot. This gun, in its magazine form, was also recommended "for farther trial in the field." This gun, having been fired, is opened by raising the handle, *a*, of the bolt and withdrawing it directly rearward; the position is shown in Fig. T′ in the engraving. As the cartridge shell is pulled out by the spring hook on the upper edge of its flanged rim, the pin which rests against its lower portion comes in contact with the front end of the trigger pin, which tips it up and throws it out of the receiver. Another cartridge is then introduced by hand or by automatic devices from the magazine, and pushed into the bore of the gun by the longitudinal forward motion of the bolt. Near the head of the bolt is seen a part of the sectional screw which engages with a corresponding section within the gun when the piece is closed, and the handle turned down into place, so as to support the bolt against the force of the discharge. The firing pin is an axial spring pin released from the bolt by a downward pull by means of the trigger and lever. Fig. T is the position "ready to fire," the driving spring being condensed and ready to act. Fig. T′ shows the bolt withdrawn and the cartridge tumbling out. When the bolt is withdrawn, the sleeve of the firing pin is so far retracted that a shoulder catches behind the trigger. When the bolt is pushed home, driving the cartridge into the barrel, it leaves the shoulder of the firing pin resting against the trigger, as shown in Fig T

*Published in numbers by Messrs. Hurd & Houghton, New York city.



Elliot's Breech-loader.

The "Springfield" Breech-loader.

The "Ward-Burton" Breech-loader.

BREECH-LOADING FIREARMS.

Astronomical Photography.

The facility and precision with which photography represents luminous phenomena in their miuute details renders this application of optics more and more important in the sciences of observation, and especially astronomy. But photography could not take a regular place in observatories unless the photographic apparatus had the same simplicity and theoretical perfection as the instruments used for current observations. M. Cornu states, in a note to the Paris Academy, that, having had occasion to study this problem in connection with the transit observations, and later at the request of the Council of the Paris Observatory, he has found a solution of it as complete as possible. The negatives he had to lay before the Academy would, he trusted, justify this opinion.

It is the peculiarity of this method that it does not require any special instrument, any telescope, and may at once be adopted for photographical observations by means of a purely mechanical arrangement, which does not at all affect the optical qualities of the instrument; the two lenses which compose the objective have merely to be separated to an extent depending on the nature of the glasses, but rarely exceeding 1½ per cent of the focal distance. This operation shortens this distance about 6 to 8 per cent. Theory and experience prove that the original achromatism of the visible rays is transformed into achromatism of the chemical rays, which is necessary to the perfection of photographic images. Direct and precise measurement has shown that this slight separation of the glasses does not cause any aberration in the images.

This method has succeeded perfectly at the Paris Observatory with the large equatorial of the eastern tower, the objective of which is 14·934 inches in aperture, and 29·13 feet in focal distance. By a very simple arrangement the glasses can be separated, and the instrument may be employed for optical as well as for photographic observations. The photographic adjustment does not present any inconvenience in observation of faint stars. M. Cornu states that he easily observed Uranus, and at least one of his satellites, without finding it necessary to re-establish optical achromatism.

At the principal focus of this instrument are obtained direct photographic images of the sun and of the moon, measuring nearly 3·42 inches in diameter: images which might be easily magnified by means of the eyepiece so as to give negatives of more than 39 inches in diameter. The images thus enlarged gain, perhaps, in artistic effect, but they lose in distinctness.

Alcoholic Solution of Shellac.

The production of a clear alcoholic solution of shellac has been the subject of numerous experiments, but hitherto none has turned out satisfactory except slow filtration. As is known, by digestion of one part of shellac with six or seven parts of 70 per cent alcohol, a solution is obtained which, when warm, is almost clear, but upon cooling becomes turbid, and is only partially clear after standing a week. The plan of pouring sufficient alcohol over coarsely powdered shellac to form a thin paste, yields, upon the addition of more alcohol after the lapse of eight or ten hours, a liquor that does not deposit any more, but which is not clear. Another method suggested, of boiling the alcoholic shellac solution with animal charcoal, gives a clearer liquid, but there is always loss through absorption by the animal charcoal.

The object sought by the author was to obtain a clear alcoholic solution in a short time without much loss. Previous communications upon the substance occurring in shellac to the extent of five per cent, which renders its alcoholic solutions turbid, and is described by some authors as wax, and by others as a fat acid, suggested an attempt to effect its removal before dissolving the shellac. The shellac, therefore, was boiled with water, from one to five per cent of soda or ammonia being added, but without satisfactory result; a somewhat larger addition of the alkali caused the solution of the shellac. The author next prepared a solution with one part of shellac and six parts of 90 per cent alcohol at the ordinary temperature, which was effected with frequent shaking in ten or twelve hours. To this he added carbonate of magnesia to about half the weight of the shellac used, and heated the mixture to 140° Fah. The solution so obtained cleared more rapidly than a solution to which magnesia had not been added, and filtered in less time; but it did not supply what was sought. When powdered chalk was substituted for magnesia, the solution, after standing some hours, became three fourths clear, while the lower turbid portion could be rapidly filtered. It only required a little alcohol to wash the filter, and a clear alcoholic solution of shellac was obtained. Further experiments, for instance with sulphate of baryta, did not give a better result. When such a solution is made on a large scale it would be best filtered through felt.

Notwithstanding that the object of the author had thus been attained, one or two other experiments were tried. To three parts of the above mentioned shellac solution one part of petroleum ether was added, and the mixture was vigorously shaken. After standing a few moments the liquid separated in two layers; the upper light colored layer was the petroleum ether with the wax dissolved in it, the lower yellow brown layer was a clear solution of shellac with only a little petroleum ether adhering. Upon allowing the petroleum ether to evaporate spontaneously, the wax that had been dissolved out of the shellac was obtained as a white residuum. By using alcohol at 95 per cent to dissolve the shellac, and then adding petroleum ether, a perfectly clear solution was obtained that only separated into two layers after water was added. Consequently an alcohol weaker than 90 per cent should be used.

The shellac solution obtained by means of petroleum ether, however, has the advantage that the shellac is left, after evaporation, in a coarser form, and easily separates; this may be obviated by adding one to three per cent of Venice turpentine.—*A. Peltz, in Pharmaceutische Zeitschrift für Russland.*

THE TAPAYAXIN.

Mr. F. W. Fanning, of Corsicana, Texas, has forwarded us a specimen of the crowned tapayaxin or horned lizard (*phrynosoma cornutum*). This curious reptile is not uncommon in the South and in California, and is stated to be very lively when at liberty, pursuing its prey with much eagerness. In confinement, however, it becomes almost torpid, remaining for some hours in the same attitude. In spite of its formidable looks, it is perfectly harmless, and can be taught to eat flies from its owner's hand. Red ants are its favorite food; but it will eat insects of all kinds. Its general color is gray, one variety (*phrynosoma Blainvilii*) being variegated with irregular bands of brown. This animal is sometimes erroneously called the horned frog and horned toad.

Mr. Frank Buckland describes a specimen in his collection as follows: "My new friend is about the size of a common sized toad, and at a distance off looks very like one. He is covered all over with spines, some of which are larger and stronger than others; he has two fixed spines, one over each eye, and three fixed spines on each side of his face. At the top of his head are situated the two biggest spines, each about half an inch long, giving him a most diabolical appearance All the spines are fixed firmly into his head. As will be seen by the picture, his body is covered with spines of different sizes, and set into his skin very thickly. The consistence of the spines reminds me much of the spines of the blackthorn. The color of the animal is gray, varied with brown and ochrey yellow; in fact it is very like the color of the bark of an old tree."

The tapayaxin sent us by Mr. Fanning has remained very quiescent since his arrival, hardly deigning to notice the flies placed in his box for his sustenance. He is apparently in good health, and his reticence of speech may be attributed to his philosophical temperament, and perhaps to some provincial bashfulness, natural to a new comer to the metropolis.

THE TAPAYAXIN OR HORNED LIZARD.

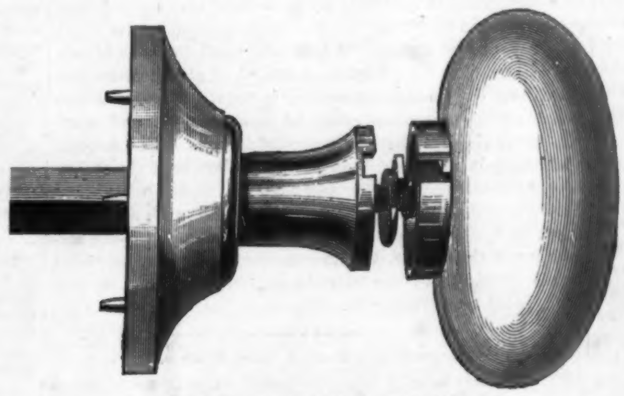
Lightning Conductors.

Dr. Mann lately showed, at the Science Conference at South Kensington, how unimportant is the form of lightning conductors, whether rods, ropes, or pipes; and that the real desideratum was that they should be of sufficient size to afford an unobstructed path for the passage of the electric fluid. He insisted on the necessity of a goodly number of points, and above all upon the indispensability of large earth contact, saying that a lightning discharge passing through a large rod with an ample earth contact is only a gentle stream of low tension; but that, if the size of the rod or the area of its contact with the earth is diminished, the tension is increased, and the fluid has a dangerous tendency to discharge itself laterally by chance outlets.

IMPROVED DOOR KNOB.

The chief failing of the ordinary door knob is that it works loose. Sometimes this occurs from the wood of the door not being properly seasoned, and hence shrinking, and frequently from the device itself not being secured to the woodwork as tightly as it should be. The above difficulty is claimed to be completely remedied in the improved knob illustrated in our engraving. The roses are secured to the door by little points on the underside. There is but one screw, which is attached to one of the knobs, and passes through the square rod. This is regulated, as shown, by a small catch pushed by a spring into a notch. As this notch represents an adjustment of but the one hundredth part of an inch, it is easy to see how well the knob can be made to fit. In mineral and porcelain knobs, the necks are secured by spurs going down in grooves and turning under the material of the knob.

The device is strong, easily adjusted, applied, or removed, simple and suitable for all kinds of knobs or latches. Further information may be obtained by addressing the Parker & Whipple Company, West Meriden, Conn., or 97 Chambers street, New York.



WHIPPLE'S DOOR KNOB.

Mechanical Photo-Printing.

The following practical directions for mechanical photo-printing are from the text of Herr Husnik:

Use for the supports some plates of glass one quarter of an inch or less in thickness, roughened on one side by means of very fine emery and water, and applied by friction from another and smaller piece of glass to which a handle is attached. Do not allow the emery to become dry, or it will produce deep scratches. A circular motion should be adopted, using considerable pressure, and in about twelve minutes a very fine grain will be obtained. If plates be employed that have been previously used, remove the gelatin by immersing in a vessel containing a solution of soda. This wash keeps more than two months, and it is always possible to strengthen it by the addition of lime. The gelatin, in the case of a plate that has been previously used, will detail itself in about twelve hours. Rinse the surface and rub with emery to remove the gelatin that may have lodged in the pores; but this time one application of the emery will suffice. The glasses thus prepared are washed in several changes of water and wiped dry with clean cloths.

First: Preparation of the plates.—Take fresh albumen 25 parts, distilled water 45 parts, silicate of soda 8 parts. Mix well together, beat to a froth, and allow to stand for several hours; then decant the clear part and filter it two or three times so as to ensure its being free from impurities.

In preparing the plates, place them, ground side uppermost, on a large slab of glass carefully leveled; and having brushed them over with a soft brush to remove all dust, pour a little of the preceding liquid near one edge, and cause it to flow over the surface by slightly inclining the large slab. If the liquid do not flow over the glass easily, it can be helped on by using a small slip of paper, taking care that it does not run too fast. Now raise one of the corners so as to allow the superfluous liquid to flow off the plates into a receptacle placed beneath; and if there be any air bubbles on the glass, pour some of the solution over it again while the glass is in an inclined position, leaving it thus to dry. The superfluous liquid can be filtered and used again. A great number of plates may be prepared in this way and kept for about six months; but it is better not to use them on the day on which they are prepared, as they improve by keeping.

In order to coat the plates with gelatin, they ought first to be carefully washed with cold water, taking care not to injure the prepared side. Let them stand upright until dry, after which they are ready to receive the gelatin, which is done in the following manner: Provide a case with a bottom of sheet iron and a curtain for the top; and in the interior, about two and three quarter inches from the bottom, place a frame, upon which stretch calico or filtering paper, so as to diffuse and equalize the heat, which is obtained from a spirit lamp. About two and three quarter inches or so from the top, bars of iron with leveling screws are placed horizontally. A thermometer, with the bulb inside and tube and scale outside, fastened at the side, indicates the temperature of the interior. Place two, three, or more of the plates on the leveling screws, laying them in a horizontal position; shut the case and heat to 110° Fah.

During this time put 15 parts of the finest French gelatin in 300 parts of distilled water, and leave it to soak for about an hour, after which dissolve in the water bath. Next, heat to a high temperature, and add 1 part of bichromate of ammonia and 1 part chloride of calcium; when these are all dissolved, add 60 parts of ordinary alcohol, after which filter. This solution is poured upon the heated plates, and must be spread by means of a small slip of paper. Experience regulates the proper quantity to be applied, and a considerable degree of dexterity will be required; but this is easily attained. Care must be taken to prevent the layer from being either too thick or too thin. The plates thus coated are placed in the case to dry at the temperature of 110° Fah., and after being well dried, they will keep in summer for about eight days, and in winter about four weeks, in a dark place; they improve by keeping.

Exposure.—With a good negative in the shade an exposure of from fifteen to forty-five minutes will be required, according to the intensity of the light—diffused light giving the best half tints. After exposing, the bichromate not acted upon by the light is removed by being washed with water, and the plate is then well drained and dried. In about three hours it is ready to be printed from.

Printing.—The plate is attached, by means of plaster of Paris, to a lithographic stone, and submitted to the action of a lithographic press. Damp the plate and ink it with two kinds of ink, one stronger than the other. After obtaining a print the plate is moistened, wiped with a cloth, and inked. If the details in the shadows be not properly brought out, put extra pressure on that part. One plate will furnish a considerable number of proofs, provided the instructions be carefully carried out and the gelatin be of good quality.

Final observation.- This method, according to Herr Husnik's experience, is the best in use, and it gives certain results. Some photographers substitute isinglass for a portion of the gelatin, but this substance can rarely be obtained of good quality.

The choice of the inks is very important. Munich varnish ought not to be used for black, as it attacks the gelatin and the plate loses its vigor. Good black printing ink answers better when mixed with red oxide of iron, and a little César varnish imparts a good brown tint.

Utilization of Waste.

Cotton waste is a singular example of the successful application of scientific utilization. It is the collected sweepings of the card room, and formerly had no value. Large heaps were suffered to accumulate until it fermented, and was then spread over the land. After that, cartridge paper makers bought it at $10 to $20 per tun; then it rose in price, and means were found to bleach and tear it up, in order that it might be respun and woven, and now there is a trade of 14,000,000 cwts., giving employment to 500 dealers. The various uses are all exhibited, and the refuse is then sold for engine cleaning, and finally to the paper maker; jute is next. An immense trade has been created. It is a product of Bengal, and formerly was used only for gunny bags, to pack rags or merchandise in, but now it yields to processes which fit it for weaving with silk or cotton, or in the making of thread, ropes, sail cloth, and with wool in flannels and carpet , and with cocoa nut fiber for matting, etc. During 25 years the consumption has risen from 391,000 cwts. to 1,250,000 cwts., and the value from $450,000 to $5,000,000, and the refuse now equals the original import of the raw material.

Failures—What they Teach.

The numerous failures and suspensions which have made the commercial world, since the panic of 1873, one of constant upheaval and change, should be utilized, by those fortunate ones who have thus far escaped disaster and by those who are entering, for the first time, the field of business life for the lessons that may be drawn from them. Failures, like every species of mishap, only follow from a sufficient cause; and usually it is one that could have easily been counteracted or avoided if the fact of its existence had not been unknown. And it is just here that we find so many of our business men weak. In their acquaintance with their own business, they lack that complete command, of the calling they have professedly made themselves master of, which alone enables one to understand and avoid its dangerous points.

The man who makes a study of or who devotes time to an accurate and scientific education in the business he has chosen, as a means for the accumulation of wealth, is now rarely found; and it seems to us that a large number of the failures of the last three years might justly be attributed to this cause. The idea seems to prevail that a business transacted on one's own account is a kind of perpetual motion, that, once started, will not only keep itself in operation, but may be drawn upon to an almost unlimited extent for the means to sustain other enterprises. The inventor who spends years in attempting to realize his impossible machine is not more certain of failure than he who starts in business with such expectation. The time when money could be made by ignoramuses, and when wealth could be had almost for the taking, has faded far away into the dim past; and an era of strife and struggle has dawned, in which only those who have most carefully prepared themselves for the warfare can hope to succeed.

It is not luck that makes one man fail and his neighbor succeed; it is not fickle fortune that brings clouds of difficulties upon one while another has apparently plain sailing; it is something far more certain in its operations than either of these. It is skill and a perfect command of his resources that enables one man to advance where another can make no progress; and these two qualities are possessed only by those who have made their business the one thing they must become perfectly familiar with.

The world is not yet so crowded that any need go to the wall to support the rest; there is room for all, and an abundance to spare. The great want is for more men who are well qualified for work, and who will put their shoulders to the wheel and push. Any person who is determined to win, and who unites with his perseverance sense enough to know that success comes only to those who deserve it, by the patience and skill with which they toil, has before him an inviting field for labor, and may enter it with the assurance that, if his efforts are rightly directed, they will meet with a sure reward.—*Northwestern Lumberman.*

FILTERS for waterworks may be calculated for as follows: 1 square yard of filter for each 700 gallons in 24 hours, formed of 2 feet 6 inches fine sand, then 6 inches common sand, 6 inches shells, and lastly 2 feet 6 inches of gravel. Perforated pipes should be laid in the lowest stratum, to carry off the supply of filtered water

Illumination of Lighthouses.

M. E. Allard, engineer-in-chief of the Administration of Lighthouses, has lately brought before the Paris Academy of Sciences some papers on the illuminating power of the flames employed for illumination, their transparency, and the translucency of the atmosphere. The first paper treated on the transparency of flames. The burners used in lighthouses have diameters of from 1 to 5 inches, and carry from 1 to 6 concentric wicks. In measuring the luminous intensity of the flames which they produce, it is found that these intensities increase a little less rapidly than the consumption of oil, and also that the intensity for each $\frac{1}{4}$ of a square inch of apparent surface increases, while, on the contrary, the intensity for each $\frac{1}{16}$ of a cubic inch of volume diminishes in direct proportion to the diameter. These results can only be explained by admitting that the transparency of the flame is not absolute.

This is the object of the first investigation made by M. Allard; he has determined the co-efficient of this transparency by three series of experiments: by measuring the intensity of different flames with a flat wick looked at sidewise or edgewise; by means of a curved mirror, which reflects towards the focus the rays which it receives, and thus causes them to pass through the flame; and by measuring the intensity of an electric light across a flame of large diameter. These investigations have led to the adoption of the number 0·8, as a mean value of this co-efficient reduced to a thickness of 0·39 inch in the flame passed through. One important conclusion is arrived at, namely, that the total quantity of light produced, or the absolute intensity, increases much more rapidly than the weight of oil consumed; but as the quantity of light absorbed, by the passage of the rays across the flame itself, increases in a still greater proportion, the difference between these two quantities, or the effective intensity, follows a law of augmentation a little less rapid than the consumption of oil.

M. Allard was next engaged on the translucency of the atmosphere. The observations made by lighthouse keepers on the visibility of neighboring lights consisted in noticing, three times each night, whether each of the lights could or could not be perceived, so that it might be ascertained, at the end of a certain number of years, how many times out of a hundred each of these lights was visible. A diagram showed, for each of the lights noticed, what is the limit of translucency in which it ceases to be perceived from the place of observation.

In another paper M. Allard has studied the impressions produced on the organ of sight by flashing lights. It appears that, by causing a series of flashes to be succeeded by equal intervals of darkness, each flash at moderate speed produces the same effects as if in an isolated state; in proportion as the speed increases, the impression on the retina is prolonged, and after a certain speed the effect is that of a constant light

Volatilized Gold.

General Howston lately donated to the Microscopal Society of San Francisco a slide mounted with volatilized gold, which, under a $\frac{3}{4}$ objective, opaque, was not only a beautiful but instructive object. The microscopic globules were perfect in shape, and were obtained at some distance from the melting pot, from which they had been thrown off by the draft and heat in a volatile form, so to speak, and condensed in the air in the form of minute shot, forming a veritable shower of golden rain. With all the care and appliances for the prevention of wastage in smelting or refining gold, a portion is lost in this way; and no doubt the roofs of the houses adjacent to mints and refineries would yield enough of the precious metal to show the color, at least, under the microscope.

Hiring Horses.

It has been decided, says the *Turf, Field, and Farm*, that when a horse or carriage is let out for hire, for the purpose of performing a particular journey, the party letting warrants the horse and carriage fit and competent for such journey. If the hirer treats the horse or carriage as any prudent man would do, he is not answerable for any damage either may receive. But he must use the horse for the purpose for which he hired him. For instance, a horse hired for saddle must not be used in harness. If the hirer violates this express condition of the contract, he is liable for any damage that may occur. If the horse is stolen through the hirer's negligence, such as leaving the stable door open all night, he must answer for it. But if he is robbed of it by highwaymen, when traveling the usual road at usual hours, he cannot be held for damages. As these questions are frequently in dispute, it is not out of place to shed a little light upon them.

Comparative Photographs of Blood.

The *American Naturalist* states that Dr. J. G. Richardson, for the sake of illustrating in criminal cases the distinguishable appearances of different kinds of blood, has flowed drops of blood from different animals so nearly in contact on the glass slide that portions of the two drops appear in the same field, and can be photographed together. Dr. C. Leo Mees has modified this method, and obtained exquisite results in specimens presented to the microscopical section of the Tyndall Association. He spreads the blood by Dr. Christopher Johnston's method, which is to touch a drop of blood to the accurately ground edge of a slide, and then draw it gently across the face of another slide, leaving a beautifully spread film. In this way one kind of blood is spread upon the slide and another on the cover. When dry, one half of each is carefully scraped off with a smoothly sharpened knife, and the cover inverted upon the slide in such position as to bring the remaining portions of the film into apposition. Under the microscope and in the photograph the two kinds of blood appear in remarkably fine contrast, even those bloods that are too nearly alike for safe discrimination in criminal cases being easily distinguished when thus prepared from fresh material.

Musical Sand.

Mr. Frink states in the "Proceedings of the California Academy of Sciences," that, in order to ascertain, if possible, "the cause of the sound that is produced by the sand from Kauai, presented to the Academy at a former meeting, I investigated its structure under the microscope, and I think the facts I have ascertained fully explain the manner in which the sound is produced. As the grains of sand, although small, are quite opaque, it was necessary to prepare them so that they should be sufficiently transparent to render their structure visible. This was effected by fastening them to a glass slide and grinding them down until one flat surface was obtained. This surface was then attached to another slide; and the original slide being removed, the sand was again ground down until sufficiently transparent. The grains were found to be chiefly composed of small portions of coral and apparently calcareous sponges, and presented under the microscope a most interesting object. They were all more or less perforated with small holes, in some instances forming tubes, but mostly terminating in blind cavities, which were frequently enlarged in the interior of the grains, communicating with the surface by a small opening.

A few *foraminiferæ* were also met with, and two or three specimens of what appeared to be a minute bivalve shell. Besides these elements, evidently derived from living beings, the sand contained small black particles, which the microscope showed to be formed principally of crystals of augite, nepheline, and magnetic oxide of iron, imbedded in a glassy matrix. These were undoubtedly volcanic sands. The structure of these grains, I think, explains the reason why sound is emitted when they are set in motion. The friction against each other causes vibrations in their substance, and consequently in the sides of the cavities they contain; and these vibrations being communicated to the air in the cavities, under the most favorable conditions for producing sound, the result is the loud noise which is caused when any large mass of sand is set in motion. We have, in fact, millions upon millions of resonant cavities, each giving out sound which may well swell up to resemble a peal of thunder, with which it has been compared; and the comparison—I know from others who have heard it—is not exaggerated. The effect of rain in preventing the sound is owing to the cavities in the sand becoming filled with water, and thus rendered incapable of originating vibrations."

Another Opportunity for Inventors.

An interesting competition is about to be opened by the German society *Verein von Gas and Wasser Fachmännern Deutschlands*, which offers a prize of $400 to the author of the process for the economical purification, from carbonic acid, of illuminating gas obtained from coal. The systems now commonly employed involve either hydrate of lime, certain salts, muriate of manganese for example, and iron oxides. Whether these methods leave more or less to be desired according to the nature of the coal distilled, or whether the forms of purifiers are imperfect, it is nevertheless certain that carbonic acid still remains present in illuminating gas, and its presence is decidedly unhealthy. Either a new system for its complete removal, or an effective improvement on the older processes, is required. The invention must be economical, easy of manipulation, and must not lower the illuminating power of the gas. The memoir describing it must be complete, and explain both the theory and the practice. Manuscripts must be signed with some distinctive device, which is to correspond with a similar mark on a sealed packet in which is written the name and address of the author. Communications are to be addressed to the president of the commission, Dr. Schilling, at Munich, prior to December 31, 1876.

Microscopic Ruled Test Plates.

"The finest lines I have succeeded in ruling are about $\frac{1}{180000}$ of an inch in width. These values are substantially the same as those given by Dr. Royston-Pigott, as representing the ultimate limit of visibility under the microscope. The smallest angle at which an object can be distinctly seen is stated by him to be 6″, while other writers place it as high as 60″, or even 120″. Even the smallest value named is much too large. I will at any time undertake to rule a single line, $\frac{1}{30000}$ of an inch in breadth, which can be seen at the distance of seven inches from the eye. This corresponds to an angle of about 1′. In this case the line is filled with plumbago; but if reflected from a silvered surface, it can be easily seen at the distance of eleven inches from the eye. Comparing minute particles of matter which can be seen under a Tolles' $\frac{1}{15}$ objective with those which can be measured, in the way indicated above, there is every reason to suppose that the limit of visibility falls beyond $\frac{1}{400000}$ of an inch. It is quite possible that the conclusion reached by Sorby, that the microscope has already reached the limit of its power in separating lines whose distance apart is equal to one half of a wave length, may be found to be justified by future observations. It is certain that no lines beyond Nobert's 19th band have ever been resolved. The great difficulty in distinguishing true from spurious lines has caused more than one skillful microscopist to doubt whether the resolution has been certainly carried as far as that point. But that light is 'of too coarse a nature' to enable us to see particles of matter, as small as $\frac{1}{2000000}$ of an inch, is a conclusion which can be refuted without the slightest difficulty."—*William A. Rogers.*

VENTILATION OF RAILWAY TUNNELS.—Mr. G. J. Morison says that, when tunnels without shafts are to be ventilated, fans should be employed to keep up an artificial ventilation; that for a given amount of traffic the power required to ventilate long tunnels varies as the fourth power of the length; that when a long tunnel is to be ventilated it is more advantageous to have a double line tunnel with trains in each direction than two single line tunnels with trains in one direction only; that for every tunnel there is a limit to the amount of traffic, where locomotives are used, beyond which ventilation becomes impossible: this limit cannot be very definitely fixed, but for a tunnel of twenty-two miles it does not exceed a total of twenty trains a day.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 4 to July 28, 1876, inclusive.

ACOUSTIC TELEGRAPH.—T. A. Edison, Menlo Park, N. J.
AXLE BOX AND OILER.—J. N. Smith, Jersey City, N. J.
BATTERY.—J. Byrne, Brooklyn, N. Y.
BOILER.—V. D. Anderson, Washington, D. C.
BOTTLE STOPPER, ETC.—S. S. Newton, Binghamton, N. Y.
CARTRIDGE PRIMER, ETC.—E. Remington & Sons, Ilion, N. Y.
CLEANING BOLT CLOTHS.—L. V. Rathbun, East Pembroke, N. Y.
CLEANING COTTON, ETC.—R. Kitson, Lowell, Mass.
COPYING PRESS.—W. B. Sargent, New York city, *et al.*
DRIVING CHAIN.—W. D. Ewart, Chicago, Ill.
ENVELOPE MACHINE.—M. S. Chapman, Hartford, Conn.
FLUID METER.—W. Smith, San Francisco, Cal.
FOLDING PAPER.—S. D. Tucker, New York city.
LANTERN, ETC.—J. E. Folk, Brooklyn, N. Y.
LUBRICATOR.—T. F. Stevenson, New York city.
OIL STOVE.—E. B. Cox, New York city.
OIL STOVE.—O. Edwards, Northampton, Mass.
PAPER-CUTTING MACHINE.—E. Schlenker, Buffalo, N. Y.
PAPER MATERIAL.—W. F. Nast (of New York city), London, England.
PENCIL SHARPENER.—J. Herts, New York city.
PIN PACKAGES, ETC.—G. C. Hoadley, New Haven, Conn.
PREPARING CHINA GRASS, ETC.—J. B. Vogel *et al.*, New York city.
PROJECTILE.—B. B. Hotchkiss, Paris, France.
SCOURING LEATHER, ETC.—F. A. Lockwood, Fall River, Mass.
SHARPENING SAWS.—W. L. Covel, Providence, R. I.
SPINNING MACHINERY.—T. Mayor, Providence, R. I.
STEAM GENERATOR.—D. Renshaw, Cohasset, Mass.
TRANSMITTING POWER.—J. Good, Brooklyn, N. Y.
WASHING BARRELS, ETC.—G. Schock, New York city.
WATCH ESCAPEMENT.—F. H. Voigt, Buffalo, N. Y.
WATCH KEY.—J. S. Birch, New York city.
WRINGER ROLLER.—G. P. Clark, Windsor Locks, Conn.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED RELEASING DEVICE FOR STABLES.

Arthur Chapman, Doylestown, Pa.—This invention consists of a longitudinal rod that extends along the manger of the stalls, and is hinged thereto, having slightly curved fingers or hooks, that retain rings, to which the cattle are fastened. A crank attached to the rod at the outside of the building operates the rod, and releases all the rings when turning the same.

IMPROVED SNAP HOOK.

Newton E. Cissna, Sioux Falls, Dakota Ter.—This is an improved snap hook for connecting the various straps, rings, and other parts of a harness, by which the straps may be readily taken out and inserted, and securely and reliably retained therein. When the tongue is swung in outward direction to be at right angles with the hook, the strap, ring, or other article is introduced, and by carrying the tongue back on the hook, firmly retained therein. The draft on the tongue causes the closing of the same, and secures the locking of the snap hook.

IMPROVED STREET LAMP.

John S. Woods, Brookline, Mass.—This consists of a duplex reflecting lamp, in which an oil holder is located between two burners, both of which are supplied from it, and it serves for the support of reflectors for the burners, to throw the light in opposite directions along a street.

IMPROVED GALVANIZING MACHINE.

George R. Acheson, Philadelphia, Pa.—This invention consists of a machine with rollers for tightening the wire cloth while passing through the galvanizing or painting liquid. Suitable skimmers and beaters are arranged in connection with the cloth at both sides of the same, to secure the regular tinning or painting. A sectional and diagonally jointed winding-up roller serves for being readily taken out of the cloth.

IMPROVED PHOTOGRAPHIC PICTURE CASE.

Thomas F. Adams, New York city.—This is a case with hinged door, to which the frame-carrying board is hinged, to be opened and closed with the door, and locked into open position by suitable spring bolts. The supporting board carries a number of photograph frames, so hinged to intermediate pieces that any one may be readily swung to either side for the inspection of the photographs.

IMPROVED LIME KILN.

Daniel G. Farrell and Andrew T. Lien, Mason City, Iowa, assignors to Farrell, White, & Lien, same place.—The object here is to afford a better application of the fire to the limestone than in kilns constructed in the usual way; to make the kiln airtight, even should it crack; to avoid the use of heavy timber and rods for tying the kiln; to cause the lime to drop evenly to the center of the draw; to avoid the necessity of drawing the lime while at a white or red heat, and to enable the lime to be dropped readily and surely. The invention consists in providing the kiln with a case and filling the space between them with clay, to render the kiln airtight, even in case it should crack in consequence of the effect of excessive heat. The invention further relates to a device for dislodging the lime and causing it to drop into the hopper.

IMPROVED LATTICE PIERS FOR TIMBER TRUSS BRIDGES.

Lewis Scott, Brighton, Mich.—In this invention two sets of posts are so arranged in a truss bridge that they will incline in opposite directions, and be located on opposite sides of the girts. They are all sustained upon a common base, that is thus connected with a superposed beam, so as to form a re-inforcement brace or support to each other. This has the effect of dividing and evenly distributing the weight or strain along the whole length of the foundation or base.

IMPROVED BRIDLE BIT ATTACHMENT.

Thomas M. Allen, Augusta, Ky.—This is an improved attachment bridle bit for driving hard-mouthed horses with great facility; and it consists of the driving lines being passed through a small pulley at the end of the bridle bit, and back through a loop in the saddle, and then downward to the shaft.

IMPROVED COMBINED PUTTY KNIFE AND SCREW DRIVER.

Charles Collins Bartlett, Medford, Mass.—This consists in combining a putty knife and screw driver in one implement, securing the sliding and spring-acted screw driver to the handle when not in use.

IMPROVED DENTAL FLASK.

William E. Buckman, Easton, Pa.—This is an improved dental flask, which shall be so constructed that it may be readily emptied of the plaster without danger of breaking the teeth. By suitable construction, after the molding or hardening of the celluloid or other material has been completed, the few taps required to separate the parts of the flask crack the plaster in such a way that it falls away from the teeth without danger of breaking them, so that the plaster and teeth are readily removed from the flask and separated from each other.

IMPROVED THIMBLE.

Gilbert H. Finger, New York city.—This invention consists in a thimble made with a concave top, and with concave surfaces, one or more, upon its sides. The tops are made thicker than the sides. The object is to prevent the eye of the needle, while being used, from slipping from the thimble and injuring the fingers of the operator.

IMPROVED SOAP RE-MELTER.

Daniel Whitaker, Boston, Mass.—The object of this invention is to provide a vessel for re-melting the scraps or filings of soap produced by the cutting up of the soap into bars while in the soap frames, whereby the said scraps are utilized by being re-embodied into a solid homogeneous mass, without burning or decomposing. It consists mainly in constructing a pot or cauldron with an open bottom adapted to be closed by a door or cut-off, and providing the interior with steam coils and a diaphragm of woven wire. The said vessels are heated by steam admitted through the steam coils, and also by a steam jacket; and as the scraps of soap are thrown into the vessel, their lodgment upon the coils and the woven wire diaphragm maintains them in suspension in a uniform steam heat until they are melted; and as soon as melted, they drop through the coils and woven wire out through the open bottom before the soap has time to decompose.

IMPROVED FEATHER RENOVATOR.

William M. Shelton, Williamsburgh, Mo.—This invention is an improvement upon the feather renovator constituting the subject of letters patent No. 108,161, and relates chiefly to a roll mounted upon a hollow perforated shaft, which is open at one end to adapt it to receive a perforated tube. Steam is admitted to the renovating chamber through the shaft and tube; but when the latter is adjusted in a certain position, the steam is prevented passing into said chamber and caused to pass into the hollow casing of the same, for heating it and thus drying the feathers.

APPARATUS FOR THE MANUFACTURE OF SULPHUROUS ACID.

William Maynard, New York city.—This invention relates to certain improvements in apparatus for hydrating gases, and it consists in the particular construction and arrangement of the condenser or chamber in which is effected the absorption of the gas by the water; the said chamber being provided with an inlet for the water above and an inlet for the gas below, and fitted interiorly with alternating inclined imperforate shelves, which are provided with ledges or cleats at their lower ends that dam up the water upon the shelves for the absorption of the gas, which water gradually weeps or trickles over the edge of the cleats from one to the other of the shelves. These ledges or cleats are also notched and sawn down to form slits or scores, which permit the draining of the shelves when the apparatus is not in operation.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WASHING MACHINE.

James J. Daly, Bloomington, Ill.—This invention consists in placing in a wash box, between two inclined parallel arms, two wash boards with their ridged surfaces facing each other. The projecting ends of the arms are provided with slots in which projections on the upper wash board travel, thus giving the latter a reciprocating motion. The lower wash board is pivoted between short arms, which themselves pivot at their lower end in the inclined parallel arms, their upper arms being connected by a transverse rail. Immediately below the wash boards is a grooved roller, which has its bearings in the two inclined arms, and is provided with ratcheted ends, which are moved by pawls pivoted to the upper wash board. Motion is imparted to the machine by a crank handle or otherwise.

IMPROVED DRY YEAST COMPOUND.

Charles W. Gschwind, Egg Harbor City, N. J.—This consists of boiled hops, scalded wheat flour, malt, sugar, ginger, rice flour, and middlings. It is well adapted for bread making.

IMPROVED STOVE COVERING.

Andrew J. Vandeventer, Martinsburg, Mo., assignor to himself and Archibald M. Vandeventer, same place.—The object of this invention is to improve the construction of the cook room refrigerator for which letters patent were granted to P. D. Vandeventer, November 8, 1870, to enable the cooking to be done with less fuel and with a more uniform heat. It consists in doors made in two parts, and with their adjacent edges overlapping each other, and at such a distance apart as to leave spaces between them for the entrance of cold air.

IMPROVED CLOTHES DRYER.

David J. Clark, East Elma, N. Y.—This consists of a series of horizontal bars, which are connected at their ends by cords, and provided with wires, for the suspension of the clothes beneath the bars. The latter are capable of being folded together or extended, and may be supported upon frames resting on the ground.

IMPROVED STOVE.

Charles R. Sipes, Arkansas City, Kan.—This relates to improvements on a class of stoves known as the "Tod" stove, by which the objectionable escape of the smoke in the same, when the doors are opened, may be avoided. There is an additional flue and damper at the highest part to prevent the escape of smoke on opening the door, and a swinging foot rail hinged to the lower part of the stove.

NEW AGRICULTURAL INVENTIONS.

IMPROVED WHEEL CULTIVATOR.

William N. Riddle, Caddo Grove, Texas.—This improved wheel cultivator is so constructed that it may be readily adjusted for use in marking the ground, covering the seed, and cultivating the plants. It is simple in construction and reliable in operation in either capacity.

IMPROVED COTTON CHOPPER.

Theodore C. Burnham, Burnet, Tex.—The essential feature of this improved cotton chopper is a contrivance of choppers on vertical rock shafts, with a cam wheel attached to one of the truck wheels, for closing them, and a spring for opening them, upon the row of plants, for chopping them out.

IMPROVED CHURN.

Sylvanus B. Robison, Allenville, Mo.—This churn may be readily put into place and detached, and the gear wheels may be readily adjusted to take up the wear.

IMPROVED BUTTER TUB.

James E. Higgins, Holland City, Mich.—This is a device for fastening covers to pails, and other similar packages, by means of a jointed hasp attached to the cover, which shuts over a staple in the pail, and a wedge placed between the hasp and cover.

COTTON FEEDER AND CLEANER FOR COTTON GINS.

George F. Colquitt, Bremond, Tex.—This invention has reference to devices for feeding seed cotton to cotton gins, and also for cleaning the same preparatory to ginning; it consists of a hopper having wires extending from side to side over a revolving toothed cylinder and a concave thrasher. It is made to reciprocate on a track by pinions on the ends of the thrasher cylinder, working in double rack bars, one in each side of the hopper, so contrived that the pinions run them over one way and under the other, making a simple and cheap mode of obtaining the motion.

IMPROVED GRAIN SEPARATOR.

William Holladay, Blairstown, Iowa.—This invention consists of contrivances for separating the light coarse matters, and also the dust, before the grain goes on to the sieves, and conducting them away in a tube out of the room containing the mill. By separating the straw, etc., before coming to the sieves, the capacity of the mill is greatly increased, in consequence of the sieves not being choked by such matters. The blast can be wholly turned on either device, or partly on both; there is a contrivance whereby a blast may be applied, by suction, to the grain as it passes off from the screen for separating light grain and like matters, not separated by the mill proper.

IMPROVED GRAIN ELEVATOR FOR HARVESTERS.

Ebenezer McFadden, Sparta, Ill.—This is a contrivance of the teeth, the apron, and the rollers which work the apron, for allowing the teeth to swing back automatically to pass the trough into which the grain falls, and in like manner take the required position for taking up the grain.

IMPROVED SULKY PLOW.

John W. Grimes, Appleton City, Mo.—This invention is an improvement in the class of sulky plows in which the plow proper is suspended from the wheeled frame in such a manner as adapts it to be raised and lowered at will, for the purpose of changing the depth of furrow, or for holding the plow entirely off the ground while being transported from one place to another. The improvement relates particularly to the construction and arrangement of parts, whereby the plow beam is held steadily while in use, adapted to be raised and lowered bodily, by means of a single lever, while in operation, and without changing the horizontal position or angle of the plow beam, and whereby the draft is applied in a direct line with the plow beam, whatever be its adjustment.

IMPROVED REAPER.

Solomon Rawson, Scott Thacher, and Isaac Rawson, Hornellsville, N. Y.—This invention relates to certain improvements in reapers for harvesting grain, and it consists mainly in making the platform and sickle-driving mechanism together, adjustable on the main frame, in raising and lowering the sickle, by pivoting the tongue to the main frame, just below the bearing or the main drive wheel, whereby the sickle and its driving mechanism are geared directly together without the intervention of a joint, and whereby also the draft is more in a line with the sickle. It also consists in the construction and arrangement of the devices for connecting and disengaging the sickle from its driving mechanism, and in the means employed for regulating the motion of the rake arms.

FERTILIZER DISTRIBUTER ATTACHMENT TO SEED DRILLS.

Lyman W. Shepard, Arcola, Va.—The invention relates to an improvement in the class of fertilizer distributers in which the material is fed through openings in the bottom of the hopper, by means of auger-shaped or spiral twist shafts. The improvement consists in the application of radial or curved arms to the feed shafts for the purpose of stirring or agitating the fertilizer and drawing it toward the feeders.

IMPROVED HORSE HAY RAKE.

Amos W. Coats, Alliance, Ohio.—This invention relates to certain improvements in horse hay rakes, and it consists in a cheap, simple, practical, and durable means of attaching a clearer for cleaning the rake teeth when elevated, the said clearer being held rigidly in an elevated position above the rake teeth upon supporting bars, projecting rearwardly from the driver's seat, and forming a part of the support for the same.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED GLOVE TREE.

John B. Stevens, Littleton, N. H., assignor to Nelson Parker, of same place.—This invention is a glove tree, made double or in duplicate, the wrist portions of the two different sized parts being joined together, so that the fingers project in opposite directions. The tree is made in sections, and a spring is placed between them to make the tree expansible and compressible. The invention also includes a sliding clamp for holding gloves while being drawn on the tree. For holding the glove on the table on bench, for inserting the tree, a vertically sliding hook plate is hooked into the mouth of the glove to clamp it on the bench, together with a foot treadle for pressing it down, and a spring for raising it.

IMPROVED MOTIVE POWER.

Adam Graner, New Orleans, La.—This invention consists in combining a drive shaft, counter shaft, and saw shaft, the latter provided with a roll arranged thereunder. The crank for turning the driving shaft, by hand, has a handle to which is attached a connecting rod, which, at the lower end, connects with a foot treadle, so that the operator may work with both. It is also proposed to apply these drivers to both ends of the driving shaft in practice.

IMPROVED WATER CUT-OFF.

Charles O. Wilson, Cincinnati, O.—This consists of a cap in combination with a crank, so applied to the cut-off pipe as to bring the mouth of the pipe squarely over the outlet, and make the communication and non-communication with the outlet perfect.

IMPROVED BARBED FENCE WIRE.

George W. Allen, Creston, Ill.—This is an improved barb for wire fences, so constructed and applied to the fence wire that it will keep its place firmly and securely, and will not slip or turn. It consists in a fence barb formed of two short pieces of wire placed parallel with each other upon the opposite sides of, and at right angles with, the fence wire, and having their end parts twisted together, leaving their points projecting.

IMPROVED RAILROAD TRACK LIFTING MACHINE.

Robert Aldred, Glencoe, Ontario, Canada.—This machine consists of a truck adapted to run on the rails, and having clamping jaws or hooks, with which the rails may be seized and raised by levers suitably arranged for the purpose. The entire apparatus is simple, and apparently effective for the purpose.

IMPROVED DISCHARGING CAR.

James W. McDonald, Campbellton, New Brunswick.—This invention relates to a novel construction of cars, designed for distributing gravel and broken stone upon railroads for the purpose of ballasting the same while under process of construction. It consists in a car provided with a supplemental frame, carrying polygonal rollers at the ends, around which passes a continuous, endless belt of sheet or plate iron, which forms the upper surface of the car. This belt is provided with a detachable connection with the running gear of the car, by means of which it is set in motion at the proper time, and the supported load is evenly distributed at the end, a second endless belt being arranged at the end transversely to the car, and inclined to the earth so as to receive the gravel and stone and carry it from its own gravity to one side of the track whenever it is desired to fill in the road bed upon the side.

IMPROVED APPARATUS FOR CONDENSING STEAM.

William Walker, Manchester, England.—This invention is embodied in a cylinder or vessel having a valve for regulating the admission of water, a flexible (rubber) button, or diaphragm, a water supply pipe at the top, a stationary perforated spray plate, a water eduction orifice near the bottom, and a steam induction orifice directly beneath the spray plate. The amount of water admitted to condense the steam, by spraying through the perforated plate, is controlled by the valve whose rod is attached to the flexible diaphragm, and hence rises or falls as the latter is caused to bulge in or out. The object of the latter is to prevent the vessel being completely filled with water when the pump is running at either high or low speed, as the case may be, so as to ensure a vacuum in the vessel, which may be supplied by the exhaust steam.

IMPROVED MACHINE FOR TWISTING HAY FOR FUEL.

James S. Foster, Yankton, Dakota Ter.—This invention is an improvement upon that for which letters patent, No. 180,218, have been granted. It relates chiefly to the combination of a rotating hook, a sliding extensible frame, carrying the fixed or non-rotating head, and devices for locking said extensible frame and the rotating head when required in the operation of the machine. The machine forms a double twist of the hay or straw, which is compact and hard, so that it constitutes a good article of fuel, and is particularly serviceable as such in districts where wood and coal are scarce and dear.

RAISING AND LOWERING PROPELLERS.

Benjamin Mitchell, Hancock, Md.—This invention relates to means for raising and lowering the propellers of canal boats, so as to cause them to work equally well whether the boat is loaded or not. The invention consists in a propeller shaft supported in side plates and raised by adjustable hangers; in an auxiliary plate at the outer bearing, that moves with the bearing plate so as always to cover the slot in the latter and prevent the ingress of water. It also consists in a plate that simultaneously slides and revolves to close the slot in the fixed plate, in which the inner bearing moves, the pinion being adapted to be operated by the same drive wheel, in whatever position it may be placed.

IMPROVED MACHINE FOR BOTTLING AERATED WATERS.

George Wenker, St. Joseph, Mo.—This is an improved machine or pump for manufacture of soda and mineral waters, by which the exact quantity of sirup to be used in bottling may be measured for each bottle. It consists of a barrel with adjustable piston and valve, in connection, with a three-way cock for the sirup and aerated water pipes, and a swinging handle lever that opens and shuts the bottle.

MACHINE FOR TWISTING HAY AND STRAW FOR FUEL.

James S. Foster, Yankton, Dakota Ter.—In using the machine, a handful of hay or straw is placed in a box and its ends are secured to the heads by clamps. The crank is then turned; and as the hay and straw is twisted, its contraction draws one head and frame inward. The movable half of the box is folded over upon the stationary half, doubling the twisted hay, which is afterward allowed to twist itself into a wisp.

IMPROVED ELEVATOR.

Thomas K. Austin, New York city.—This consists in the arrangement of elevators working on guides in wells or shafts, provided at the front and rear of the building. The said elevators are connected above and below by ropes or chains, in such a manner that they may counterbalance each other, and are each provided with gearing, which can be operated by one or more persons on the elevator, to raise or lower it, as may be desired.

IMPROVED GATE LATCH.

Cirby J. Wallis, Troy Station, Tenn.—The latch has a curved rear arm, which is extended to a suitable length beyond the pivot to give the required weight for producing automatic locking. When the latch is applied to doors that are to be opened from both sides, knobs are arranged in connection with a lever that serves to raise the latch by turning either knob.

IMPROVED WEIGHING SCALE.

Hosea Willard, Vergennes, Vt.—The object of this invention is to contrive a lever and beam scale in a simple way that will allow of being suspended for use, and at the same time will be efficient in operation. The weight hook pivot is connected adjustably to the beam lever, and provided with a shifting screw to set the scale for net or gross weight. And there are other ingenious devices well suited to the ends in view.

MACHINE FOR SHAPING GRAIN CRADLE FINGERS.

Andrew Denney, Beverly, O.—This consists of a disk having a groove in the face, corresponding in form to one half the cross section of the finger, with a number of radial notches, in each of which is a cutter having a notch of corresponding form. The cutters are bolted to lugs of the disk projecting from its sides. The disk is made to revolve against the blank, which is first dressed on one side and then on the other.

IMPROVED TIME LOCK.

John B. Overmyer and James A. Huston, New Lexington, O.—This consists of a time piece having a screw connected with one of the posts of the time mechanism, to be turned thereby. On the screw is a nut, which is made to operate the releaser, which lifts the stop from behind the bolt of the lock, the screw being geared to the time piece by friction devices, and having a thumb disk to facilitate the setting of the nut. A graduated scale is arranged in connection with the nut, by which to set it to release the bolt in any predetermined length of time.

IMPROVED CAR COUPLING.

Hiram Pitcher, Fond du Lac, Wis.—This consists of a double coupling hook, that is hinged to the drawbar and united at the front part, to lock over the side extensions of the drawbar to be coupled. The double hooks are raised or lowered by rods extending to the top or side of the car.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries

W. C. W. will find directions for purifying his cistern water on p. 395, vol. 32.—R. C. C. will find a description of an incubator on p. 273, vol. 33.—E. F. Y. can waterproof his boots by following the directions on p. 154, vol. 26. Wire will do as well or better than string for the two cent telegraph.—G. P. A. will find a recipe for a durable paint for iron on p. 319, vol. 31.—W. R. H. is informed that a steam derrick is commonly used for raising a sunken ship.—A. P. M. can clean light leather shoes by the process described on p. 68, vol. 34.—W. C. M., J. C. L., J. H. D., E. L., R. R., J. H. P. & Co., S. & E., and many others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. McA. says: 1. I have produced colors from a certain bug, and I have also procured a color from the gum of the fir tree. How can I tell whether they are dyes or not? A. Treat them with the various solvents, such as water, alcohol, acid liquids, alkaline solutions, etc., until you discover the proper solvent. Then experiment with the solution obtained on woolen and other goods with the various mordants. 2. How can I separate nitric acid from a mixture without altering the nature of the mixture? A. You fail to state with what the acid is associated. It is necessary to know this in order to answer your question.

(2) J. W. and others.—We do not think that feathers are generally injured by steam heating. We believe this method is considered one of the best ways of purifying feathers.

(3) A. S. asks: 1. Is a person liable to get the hydrophobia from having been bitten by a dog entirely free from it? A. No. 2. How soon does it make its appearance? A. Sometimes years elapse, but it is oftener developed in a few days or weeks. 3. What are its first symptoms? A. It is characterized, as its name implies, by a singular loathing for water, also by violent spasms of pain in the spinal column and brain.

(4) J. W. W. says: A friend contends that whisky, brandy, etc., increase in strength after they are three years old. I contend that they continue to decrease as long as there is any spirit remaining. Which is correct? A. As far as we have observed, the liquors, if kept in barrels, decrease constantly in the percentage of alcohol by evaporation and otherwise.

(5) J. E. F. asks: What can I mix with cotton seed oil, as a substitute for boiled oil in paints, and to make it act as a dryer? A. Litharge.

(6) A subscriber asks: Is it possible for an iceboat sailing in any direction to sail faster than the wind? A. Yes. On smooth ice, sailing at the proper angle, ice boats often move much faster than the wind. The wedge principle is involved. For example: a wedge two inches square at the head, six inches long, sloped on one side to point. If such a wedge be introduced between two sufficiently strong bodies, one of which is fixed, the other movable against the sloping side of the wedge: if sufficient force is applied to the movable body, it will expel the wedge, which latter must move six inches, during the same time that the impelling body moves two inches. The ice boat sail is the wedge, ice the fixed body, wind the force acting against the sloping side of the wedge.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. M. N.—It is clay containing a large percentage of carbonate of lime.—E. W.—It is an trilobite, found in the older fossiliferous rocks. It was long supposed to be an insect fossil, but it was at length ascertained that it corresponded most nearly to the living genera of crustaceans, the *gerolis, lumulus, branchipus*.—D. K. C.—The specimen appears to be brown coal.—H. & J.—The specimen of clay is of unusual purity, and gives a very clear porcelain.—G. H. S.—Nos. 1 and 3 are magnetic oxide of iron (lodestone). No. 2 is spiegeleisen, a carburet of iron with manganese.—R. C. J.—Your sample appears to be a scrap of spiegeleisen—a carburet of iron.—F. T. M.—The water contains a considerable quantity of carbonate of iron in solution, which, on exposure to air, is precipitated by the escape of the carbonic acid with which the water is charged. The sediment consists of hydrated sesquioxide and carbonate of iron, together with some carbonate of lime. The water will be improved by the addition of a little lime water—not too much.—R. Y. G.—It is an impure clay containing iron. It might be employed for the purpose you mention. There is an alloy commonly known by the name you mention.—We have received a slate pencil box, not labeled, containing a number of pieces of granite, gneiss rock, and hornblende.

J. A. P. asks: In making fruit butter, etc., I am anxious to know if the dried fruit is wholly used, or is there a mixture of both dried and fresh? Is it ground, or reduced by boiling, etc.?—A. R. asks: Can any one inform me of the process of making lager beer?—P. McS. O'F. asks: What purpose does the two-fold division of the back and belly of a violin serve? Is the belly carved or scooped out to the proper shape, or is the material steamed and then compressed to the required shape?—J. N. J. asks: How much does a wagon axle need to be set under, and why should not the under side be straight or level as it lays in the box? Does the concavity of the wheel make any difference as to the setting of the axle? Is not a straight wheel better and stronger than one that is concave?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Moon's Longitude. By J. H.
On Working Men's Education. By A. S.
On Weight on and in the Earth. By H. A. H.

Also inquiries and answers from the following:

G. F.—L. H.—H. T.—F. T. H.—E. C. W.—W. C.—C. C.—C. F. S.—J. E. K.—F. E. H.—M. D. H.—G. T. W.—J. F. C. G.—V. T. B.—G. W. P.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells friction match making machinery? Whose is the best railway ticket printing machine? Why do not makers of telegraph batteries advertise in the SCIENTIFIC AMERICAN? Who sells the best carriage varnish?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 1, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air brake relief valve, C. Chadwick	180,460
Air compressor, D. Wood	180,44
Alarm circuit closer, W. J. Phillips	180,497
Awning, A. Hessels	180,580
Bed and cushion, air, W. Boggett	180,528
Bed bottom, spring, W. R. Cunningham	180,555
Bedstead, sofa, H. York	1?0,694
Bee hive, C. M. Jones	180,596
Belt, W. Roemer	180,500
Bending machine, Scott & Schultz	180,436
Beverage, composition, Winder *et al.*	180,692
Billiard ball composition, etc., G. Magnus	180,484
Bin, meal, J. Hunter	180,590
Birdcage hook, J. Maxheimer	180,432
Boats, etc., sail, T. Winans	180,691
Boiler plates, shearing, J. & T. McGregor	180,614
Boiler, wash, A. Lohmann	180,608
Boiler circulating apparatus, W. C. Lang	180,601
Boiler, feed water heater, etc., T. R. Butman	180,458
Bolt-threading machine, A. Ward	180,681
Book and cover, S. L. Robinson	180,642
Boot counter stiffeners, forming, G. F. Moore	180,492
Boot heel stiffeners, cutting, G. Boivin	180,530
Boot soles, channeling, J. Dargan	180,419
Bottle, caster, H. Waudby	180,508
Bottle-corking machine, J. A. De Mestre	180,5?9
Bottle stopper, J. Conner	180,551
Box-nailing machine, G. W. Swan	180,503
Breastpin joint or tongue, C. E. Smith	180,437
Bridge, draw, G. Moody	1?0,491
Broiler, F. O. Badger	180,519
Bung vent, A. J. Klein	180,479
Bustle, J. Jenkinson	180,593
Butter dishes, clasp for, T. Van Skelline	180,506
Buttons, ornamenting, S. S. Moyer	180,621
Can nozzle, oil, R. H. Hasenritter	180,426
Car axle, R. W. Nelson	180,494
Car axle washer, W. H. Fitz Gerald	180,566
Car coupling, J. A. Patterson	180,629
Car windows, fender for, R. P. Proctor	180,635
Carbureters, regulating heat of, Randall *et al.*	180,638
Carding machine feeder, W. C. Bramwell	180,533
Carpet fabric, J. Allison	180,515
Carriage, child's, R. G. Britton	180,534
Carriage seat, Hubbell & Ruff	180,427
Carriage slat iron, W. S. Ward	180,509
Cartridge, Welsh & Evans	180,510
Cartridge primers, removing, H. G. Wolcott	180,698
Caster, furniture, F. Helling	180,477
Casting, chill for casting, A. K. Rider	180,641
Chair, child's, Lass & Glarner	180,602
Chair, nursery, J. Kopp (r)	7,246
Chair, reclining, R. & W. McCabe	180,435
Chair, tilting, F. Chichester	180,548
Churn, G. Ridler	180,640
Churn, A. Woodard	180,514
Cigar box, S. Hood	180,586
Clock alarm, S. Johnson	180,594
Clothes dryer, A. S. Whittemore	180,686
Clothes pin, G. A. Lambert	180,430
Clothes pin holder, G. A. Lambert	180,431
Cock and faucet, F. Brenner	180,456
Coffee pots, tea kettle, etc., cover, K. Eberle	180,469
Coffin handle, F. X. Gartland	180,570
Constipation, etc., remedy for, G. S. Coleman	180,418
Crushing machine, F. Motte	180,620
Cuff and collar box, E. Scheel	180,650
Cultivator, Lynch & Wright (r)	7,250
Cultivator, W. P. Stalcup	180,438
Curtain fixture, G. W. Cornell	180,463
Curtain fixture, C. H. Miller	180,489
Curtain stretcher, lace, J. Gilray	180,572
Damper regulator, G. Beane	180,522
Diffusion apparatus, C. Neames	180,623
Disintegrating molten scoriæ, A. D. Elbers	180,470
Doll supporter, E. C. McCutchins	180,613
Door, Carrera *et al.*	180,544
Doors, etc., roller for barn, S. H. Moore *et al.*	180,619
Drill bit, metal, G. B. Cubberley	180,554
Drills, expanding metal, P. Duffy	180,561
Earth-boring machine, A. W. Morgan	180,493
Elevator, hydraulic, J. Perkins	180,496
End gate, H. Swintz	180,673
Engine, rotary, W. F. Leopold	180,606
Engine, rotary, W., Sr., & W. Stillman	180,662
Engine, steam, Smith & Mason	180,664
Engines, locomotive, etc., Metcalfe *et al.*	180,488
Engine, valve for steam, J. R. Maxwell	180,433
Evaporating apparatus, J. E. Weaver	180,441
Evaporator furnace, Towers *et al.*	180,677
Faucet, L. Dreyfus	180,560
Faucets, replacing worn-out, T. W. Rees	180,639
Fence, flood, Achor & Ball	180,407
Fence, iron, Walker & Devoe	180,507
Fence wire, barbed, H. B. Scutt	180,656
Fertilizer distributer, D. C. Brown	180,536
Fire arm, breech-loading, F. W. Freund	180,567
Fire extinguisher, lint room, F. L. Ellis	180,565
Fur set box, W. A. Lynn	180,481
Furnace, H. Harrison	180,476
Furnaces, feeding fuel to, A. Cockrell	180,550
Game apparatus, C. Sonnenberg	180,502
Gas and air, mixing, L. B. Bellingrath	180,527
Gas, etc., lighting, Bell & Thorp	180,536
Gas, lighting, Hufeland & Batchelder	180,588
Gas, lighting by electricity, A. T. Smith (r)	7,249
Gas for motive power, heating, W. N. Hill	180,478
Gas meter, R. C. Phillips	180,631
Gas washer, E. S. Cathels	180,459
Gate-closing device, R. S. Higinbotham	180,583
Glass-blowing apparatus, W. Beck	180,451
Glass furnace, P. Arborgast	180,517
Glass-grinding machine, T. Hipwell	180,584
Glass mold, W. Beck	180,450
Glass bucket, pressed, W. Beck	180,452
Grain, preparing cereal, F. Schumacher	180,654
Grate, G. B. Mershon	180,616
Hame, E. D. Collins	180,462
Hammer, steam, F. B. Miles (r)	7,248
Harness frame, L. J. Knowles	180,599
Harness saddle, R. Spencer	180,670
Harness saddle tree, A. Teas	180,676
Harrow, W. C. Moore	180,617
Harrow, G. E. Pounder	180,498
Harrow, W. S. Weir	180,684
Harvester, bean, W. Bradford	180,455
Harvesters, inside divider for, J. Moore	180,618
Hinge, lock, P. J. Dinn	180,420
Hog trough, N. A. Clark	180,549
Hopper, feeding and discharging, H. J. Huttner	180,591
Horse collar, W. Hamley	180,425
Horseshoe, M. H. Wilcox	180,442
Horseshoe, elastic, Braffett & Perkins	180,532
Horseshoes, making, H. J. Batchelder	180,448
Hosiery, etc., ornamenting, W. Parsons	180,628
Hydrant fire, L. S. Woodbury	180,444
Ice cream freezers, J. Dooling	180,421, 180,422
Ice creeper, T. Gunsalus	180,578
Implement combined, L. Beach	180,521
Indicator, etc., station, F. W. Brooks	180,457
Inkstand, W. J. Schilling	180,652
Jack, hydraulic, P. Hinkle (r)	7,247
Jack, lifting, T. J. Corn	180,552
Key fastener, W. A. Phillips	180,496
Kneading machine, P. Freyburger	180,568
Knife, hominy, J. Outcalt	180,626
Ladder, F. D. Randall	180,637
Lamp, A. Bechet	180,449
Lamp extinguisher, W. W. White	180,687
Lamps, lighting, Hufeland & Batchelder	180,587
Lamp wick, W. H. Lyon	180,482
Lantern, signal, J. M. Shank	180,658
Leather-cutting gage, J. Potter	180,633
Leather-shaving tool, J. Smith	180,667
Lock for doors, J. P. Sipp	180,668
Locks to drawers, etc., attaching, W. J. Schilling	180,651
Lubricator, Smith & Collins	180,666
Lubricator, thermoscopic, E. D. Tyne	180,505
Mail bag catcher, E. W. Jones	180,595
Map, dissected, W. H. Harrison	180,476
Meat, preserving, J. Parent	180,627
Metals, machine for molding, W. Barker	180,411
Mill chopping, D. Gartman	180,472
Miter box, G. C. Bowen	180,454
Mowing machine, Peck & Keeler	180,630
Motive power, heating gas for, W. N. Hill	180,478
Music leaf turner, T. J. & L. M. Beebe	180,525
Music leaf turner, E. B. Robinson	180,499
Nut lock, Bushong & Fitzpatrick	180,414
Ores, amalgamating, C. T. Secor	180,657
Padlock, R. Thompson	180,504
Paint, etc., package for, G. Sidey	180,661
Paper bag fastening, H. S. Gillette	180,571
Paper bag machine, R. K. Hughes	180,589
Phosphate dryer, reel, etc., Clarke & Curtiss	180,415
Pianoforte sound board, C. F. T. Steinway	180,671
Pianofortes, stringing and tuning, M. N. Gage	180,424
Pipe cutter and threader, G. Sanford	180,649
Planter, corn, A. J. Greenman	180,473
Planter, corn, N. H. Meeks	180,615
Planter, corn, J. D. Smith	180,665
Planter, corn, R. E. Zellers	180,695
Planter, seed, W. T. Easterday	180,468
Plow, Newman & Wilkinson	180,624
Plow, A. A. Preston	180,634
Plow, Wiard & Hough	180,511
Plow and seed drill, listing, A. M. Coston	180,553
Plow, gang, M. S. & E. W. Curtiss	180,464
Plow, potato, T. C. Baxter	180,520
Plow stock, Davis & Aycock	180,556
Plow corn planting attachment, S. M. Scott	180,625
Postage and revenue stamp, L. H. G. Ehrhardt	180,56
Press, baling, E. Fales	180,471
Printing press, plate, J. Milligan	180,490
Pulleys, grooving metal, J. D. Alvord	180,409
Pump, beer, P. Krumscheid	180,600
Pump bucket, chain, J. F. Daugherty	180,465
Pump governor, J. S. Leas	180,604
Pump, steam, J. Mayher	180,434
Pump, stocks, cylinder for, P. Wineman	180,513
Railway, elevated, S. H. Shreve	180,660
Railway gate, D. H. Bucher	180,540
Railway gate, D. K. Mabie	180,483
Railway switch, W. Buchanan	180,539
Railway switch, C. H. White	180,685
Recording apparatus, A. A. Anderson	180,516
Sad iron, L. M. Davis	180,557
Safe, marine, J. L. Gouley	180,575
Sand and gravel separator, S. Friend	180,569
Sand, crushing and washing, J. R. Smith (r)	7,245
Saw filer, gin, F. Charter	180,547
Saw mills, feed motion for, P. Prybil	180,636
Saw, pile, D. Bean	180,523
Saw tooth, insertible, E. C. Keys	180,429
Sawing machines, table for, F. J. Betts	180,412
Scissors, making, J. Adair	180,408
Scissors sharpener, screwdriver, etc., G. D. Dean	180,466
Scow, self-dumping, P. L. Murphy	180,622
Seeder, cultivator, etc., J. P. Long	180,609
Separator, grain, W. W. Ingraham	180,428
Separator, middlings, J. Graham	180,576
Settees, L. Heywood	180,581, 180,582
Sewing machine, J. Butcher	180,542
Sewing machine shuttle, J. Butcher	180,541
Sewing straw braid, S. C. Brown	180,538
Shears and scissors, G. H. Taylor	180,675
Shears, sheep, R. H. Austin	180,410
Sheep collar, J. A. Armentrout	180,518
Shirt, Z. S. Durfee	180,562
Shirt, M. Kayser	180,598
Shoe tip, L. Loeser	180,607
Shoe uppers, etc., cutting, E. B. Stimpson	180,672
Shovel, snow, E. Campbell	180,543
Show case, E. R. & G. W. Lee	180,605
Signal, fog, G. Sweanor	180,674
Skate, parlor, C. W. Saladee	180,646
Skirts, etc., tape for, T. C. Cassidy	180,545
Sleigh knee, R. G. Britton	180,535
Snow plow, E. Brown	180,537
Soap remelter, D. Whitaker	180,688
Sole edge burnishing, tool stock, G. A. Fullerton	180,423
Spark arrester, W. F. Grassler	180,577
Spikes, making, G. N. Sanders	180,648
Spinning ring, J. Booth	180,529
Spinning ring, W. H. Magee	180,611
Spring, door, F. W. & I. Porter	180,632
Spring, door, C. T. Sabin	180,644

Stamp cancelers, C. W. Saladee.........180,501, 180,647
Stockings, forming feet of, W. H. Abel.......... 180,446
Stool, camp, C. M. Lungren.......................... 180,610
Stove, heating, P. O. Jenkins......................... 180,592
Stove, lamp, A. Gulliford.............................. 180,474
Stove, oil, J. McConnell................................ 180,496
Stove pipe coupling, L. E. Clow...................... 180,416
Stove pipes, beading, A. Syversen.................... 180,440
Straightening round bars, etc., J. B. Root....... 180,643
Straw cutter, W. Kaehni................................ 180,597
Straw cutter, Watson & Merwin...................... 180,445
Table, folding, C. McDonald........................... 180,487
Tank, oil, E. F. Wilder.................................. 180,512
Tanning hides and skins, Dussaud *et al*.......... 180,563
Tea pots, bottom for, E. B. Manning................ 180,485
Telegraph key, self-closing, G. Southard......... 180,669
Testameter, E. F. Osborne............................. 180,675
Top, humming, Goodwin & Mayer.................... 180,573
Torch, G. F. Hollis.. 180,585
Torch, I. W. Shaler.. 180,659
Toy furniture, F. Voigt................................... 180,680
Toy money box, A. C. Gould............................ 180,574
Trace detacher, J. Buckley.............................. 180,413
Trap, animal, H. S. Davis................................ 180,558
Turpentine, purifying, L. J. Duroux.................. 180,467
Twisting machine, tension, P. A. Chadbourne.... 180,546
Urinal, J. M. Wilson...................................... 180,689
Vehicle brake, automatic, J. H. Sale................ 180,645
Vehicle hub, W. F. Bodine............................... 180,453
Vehicle hub, T. Beatty.................................... 180,524
Vessels, sailing, T. Winans.............................. 180,690
Wagon body, J. Barnhart................................. 180,447
Wagon, platform spring, J. G. Clark.................. 180,461
Wardrobe, V. Klobassa.................................... 180,480
Wash board, J. S. Washburn............................ 180,682
Watch regulator, E. G. Boynett......................... 180,531
Watch regulator, Hawkins & Higginbotham...... 180,579
Water closet, J. H. Stevens............................. 180,439
Water wheel, S. G. Marlin................................ 180,612
Weather strip, W. Watkins............................... 180,683
Winch, E. Sorrinson.. 180,668
Wind wheel, H. M. Underwood......................... 180,678
Wind wheel, A. M. Vanpelt............................... 180,679
Windmill, D. R. Leach..................................... 180,603
Wrench, screw, F. L. Coes............................... 180,417
Yarn, sizing, L. Schönheer............................... 180,653

DESIGNS PATENTED.

9,411.—TORCHES.—G. F. Hollis, Boston, Mass.
9,412.—WINDOW SHADES.—B. G. Latimer, Brooklyn, N.Y.
9,413.—CROSS.—W. B. Menage, Providence, R. I.
9,414.—CLIP BAR.—W. S. Ward, Plantsville, Conn.
9,415.—INKSTANDS.—W. B. Bennage, Jr., Phila., Pa.
9,416.—CHAIN LINKS.—O. M. Draper, N. Attleboro', Ms.
9,417.—BOTTLES.—B. W. Fetters, Philadelphia, Pa.
9,418.—BADGE, ETC.—E. H. Hart, Philadelphia, Pa., *et al.*
9,419.—BADGE.—A. Powell, New York city.
9,420.—SPOON HANDLES, ETC.—G. Wilkinson, Prov., R.I.
9,421.—CIGAR LIGHT.—G. A. Woods, Meriden, Conn.
9,422, 9,423.—COFFIN ORNAMENTS.—R. H. Burr, West Meriden, Conn.
9,424.—WOOLEN FABRICS.—D. L. Einstein, N. Y. city.
9,425.—WATERPROOF FABRICS.—D. L. Einstein, N. Y. city.
9,426 to 9,431.—OIL CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
9,432.—BADGE.—A. V. Moore, Hackensack, N. J.

[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

Advertisements.

Advertisements.

Back Page - - - - - - - - $1.00 a line.
Inside Page - - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet containing the laws and full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner F and 7th Streets, Washington, D. C.

WHOM IT PAYS!

As a rule, it pays best to advertise what one has to sell or wishes to purchase, in papers having the largest circulation among the class of persons likely to be interested in the article. Parties having Manufacturing Establishments to sell or lease, or who wish Estimates made for Constructing Bridges, Dams, Iron Buildings, Furnaces, Heating Apparatus, Steam Engines, Boilers, Wood and Iron Working Machinery, Agricultural Implements, or Contracts for Engineering Works of all kinds, will find that it pays to advertise in the SCIENTIFIC AMERICAN.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be over-estimated. It goes into all the machine and workshops in the country, and is taken at the principal libraries and reading rooms in the United States and Europe.

The SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT have a larger circulation than all other papers of their kind in the world combined; and at no period since the commencement of the publication of these papers has the weekly circulation been as large as at the present time.

The actual issue of the SCIENTIFIC AMERICAN is **47,500** per week, and of the SCIENTIFIC AMERICAN SUPPLEMENT, **15,000**, making the combined circulation, **62,500** every week.

If anything is wanted in the mechanical line, advertise for it in the SCIENTIFIC AMERICAN.

If one has a patent or machinery to sell, advertise in the SCIENTIFIC AMERICAN.

If any one is exhibiting at the Centennial, it will pay them to advertise where they may be found.

For rates, see the first column of the last page of this paper.

The Supplement.

Next to the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT has the largest circulation of any paper of its class published. The SUPPLEMENT is a distinct publication from the SCIENTIFIC AMERICAN, and has a large circulation other than among the subscribers of the regular edition. Terms for advertising are very low, as follows:

Back Page, tinted cover....35c. a line } EACH
Inside page..................25c. a line } INSERTION.

Discount for large space, and to quarterly advertisers. Address the publishers,

Munn & Co.,
37 Park Row, New York.

THE VALIDITY OF PATENTS.

The inexperienced purchaser of a patent does not generally appreciate the importance of having its claims examined, and their validity and scope defined by some person experienced in such matters, before parting with his money. It is not unusual for the assignee, just as he is commencing the manufacture of articles under his recently purchased patent, to find that it is an infringement upon some previously issued patent, and that he has not only made a worthless investment, but that he is likely to get mulcted in damages if he proceeds with his manufacture. Cases are continually coming to our knowledge wherein parties have made purchases in good faith, and paid considerable sums of money on the assurances of the patentee and a mere glance at the patent, presuming that all that the drawing of the invention showed was protected by the claims, when, in fact, the point covered was almost infinitesimal. Another manner in which purchasers are sometimes deceived is that the claims, although broad enough and worded properly to cover the invention, contain a single element protected by some prior patent, which covers the very part in the new machine which is necessary to insure its efficiency. The Howe sewing machine patent illustrates this. It protected but little that any of the manufacturers cared to use, except the one small part essential to all sewing machines; and all manufacturers had to pay Howe a royalty, and he derived from that apparently trivial item an immense income.

We therefore recommend any person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement, as above suggested, or not. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address

MUNN & CO.,
37 PARK ROW, New York.

The "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK Tenth and Lombard-sts., Philadelphia, and 59 Gold st., New-York.